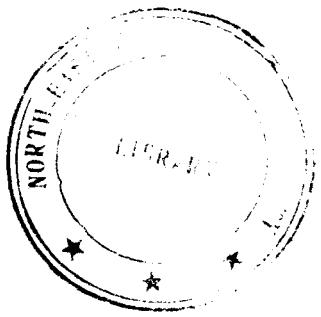
STUDY ON THE PTERIDOPHYTIC FLORA OF NAGALAND



By

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DEPARTMENT OF BOTANY
SCHOOL OF LIFE SCIENCES

Submitted in fulfilment of the requirement of the

DEGREE OF DOCTOR OF PHILOSOPHY

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CERTIFICATE

I certify that the thesis entitled 'STUDY ON THE PTERIDOPHYTIC FLORA OF NAGALAND' submitted by N.Sakutemsu Jamir for the degree of DOCTOR OF PHILOSOPHY of the North-Eastern Hill University embodies the record of the original investigation carried out by him under my supervision. He has been duly registered, and the thesis presented is worthy of being considered for the award of the Ph.D. Degree. This work has not been submitted for any degree of any other University.

R. Raghavendra Rao

Dated: 30/6/82
Shillong

(R.R.RAO)
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INTRODUCTORY

INTRODUCTION

Pteridophyta, the first group of spore-bearing vascular plants, include the fern-allies (*Lycopodium*, *Selaginella*, *Equisetum*) and the true ferns. The latter constitute a major group of living pteridophytes, which are adapted to a wide variety of habitats. Pteridophytic flora of northeast India is specially quite rich, on account of the favourable climate and plentiful moisture, and form a conspicuous feature of the vegetation and landscape. But unfortunately, this group of plants has not received due attention by plant explorers and flora writers, mainly because of the difficulty involved in their identification.

Nagaland, one of the hill states in northeast India supports a very rich and luxuriant vegetation. This state, which came into existence on 1st December, 1963, formed a part of earlier Assam, which is considered to be one of the richest and interesting 'Botanical Provinces' of the Indian subcontinent. But still, there is no comprehensive flora of this state, though Nagaland along with the neighbouring regions once formed a famous hunting ground for a number of British botanists from time to time (Buchnan-Hamilton, 1820; Roxburgh, 1820-24; Griffith, 1837; Masters, 1844; Hooker, 1855, 1872 - 1897; Hooker and Thomson, 1851; Clarke, 1880, 1889; Bor, 1940, 1942). Masters's (1844) remarks on the flora of Naga Hills "I presume it would occupy an experienced Botanist 10 years to explore the whole of Naga Hills, from the Booreedihing to the Dhunsiri in a satisfactory manner,

none of them having been hatherto visited by any Botanist" partly holds good even today.

The only regional account of the flora is that of Kanjilal et al., (1934-40), which deals only with dicotyledonous species (except for Poaceae by N.L.Bor, 1940). Pteridophytes plants are totally excluded in this work. Further, subsequent to the publication of this regional flora (Kanjilal et al., 1934-40) there has been a large scale alteration in the native flora of the state, owing to the practise of the so called 'jhuming' or shifting agriculture (Rao, 1978). It is therefore, not only essential but worth recording the plant species of the state before we are left with many barren grass-covered hills, devoid of any luxuriant vegetation. Besides, basic information about plant species is highly essential for fuller exploitation of our plant resources, and this is particularly so for a state like Nagaland, which along with other states in northeast India is on the threshold of numerous intensive programmes of development.

After the reorganisation of Botanical Survey of India and with the establishment of a separate regional circle at Shillong in 1956, some significant collections have been made from Nagaland but with a bias towards flowering plants. Further, these collections are mostly centred around Kohima and Mokokchung districts. The only existing fragmentary accounts of Pteridophytic plants of the earlier Assam (including the present Nagaland) are those of Panigrahi (1960) and Kachroo (1953,1975), and these again are based

on insufficient collections.

Thus, there exists a conspicuous gap in our knowledge of the flora of Nagaland, and as a prelude towards achieving a full flora of the state, the present account 'Pteridophytic flora of Nagaland' is attempted here, based on extensive collections and first hand field informations gathered during 1978 - 82.

LOCATION AND AREA

The state of Nagaland lies between 25°6' - 27°4' N and 93°20' - 95°15' E in north-east India and has an area of 16527 km^2. It is bordered on the north by Arunachal Pradesh, on the west and north west by Assam on the south by Manipur and on the east by Burma (Fig. 1). The altitude varies from 194 m to 3048 m, with the highest peak lying in Saramati hills in the Tuensang district on the Burma border.

Present Nagaland which includes Naga Hills district of Assam (established in 1881) and the Tuensang division of North-East Frontier Agency (NEFA) is divided into 7 administrative units or districts, viz., Kohima, Phek, Mokokchung, Wokha, Zunheboto, Tuensang and Mon; each district being inhabited by a distinct subtribe of the Nagas.

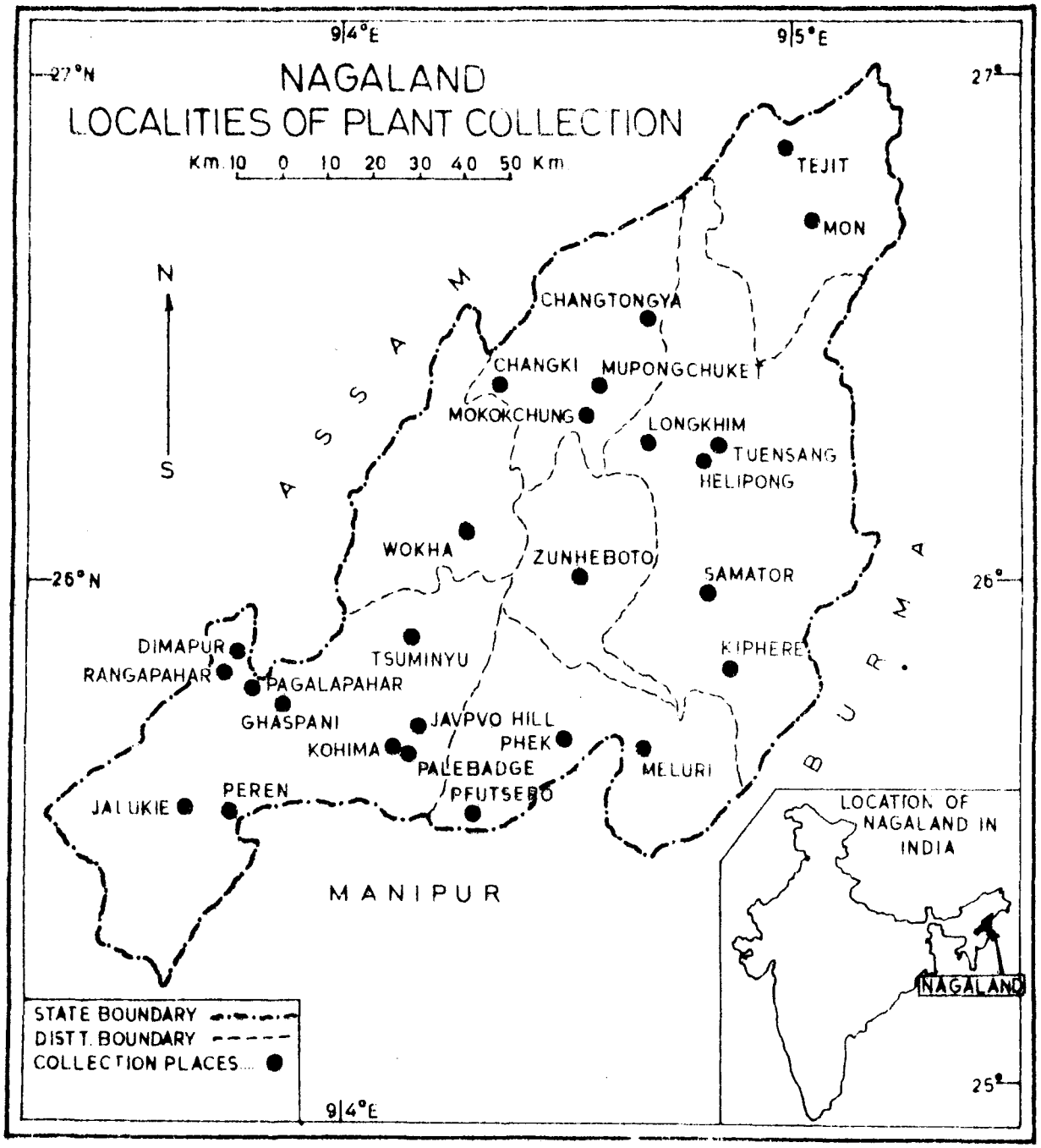
NAGALAND
LOCALITIES OF PLANT COLLECTION
Km. 10 0 10 20 30 40 50 Km
94°E
95°E
27°N
26°N
N
S
ASSAM
BURMA
TEJIT
MON
CHANGTONGYA
CHANGKI
MUPONGCHUKET
MOKOKCHUNG
LONGKHIM
TUENSANG
HELIPONG
WOKHA
ZUNHEBOTO
SAMATOR
KIPHERE
DIMAPUR
RANGAPAHAR
PAGALAPAHAR
GHASPANI
TSUMINYU
JAVPVO HILL
KOHIMA
PHEK
PALEBADGE
MELURI
PFUTSERO
JALUKIE
PEREN
MANIPUR
LOCATION OF NAGALAND IN INDIA
NAGALAND
STATE BOUNDARY
DISTT. BOUNDARY
COLLECTION PLACES

Fig. 1

PHYSIOGRAPHY AND DRAINAGE PATTERN

Nagaland is entirely hilly except a narrow belt of foothills bordering Assam and the small valleys in between the lower ranges of the western and north-western flank. The Barail range flanks the boundary with Burma and the highest mountain summit 'Saramati' (3048 m) lies on this range. Apart from this, there are numerous other hill ranges, such as Japvo in Kohima district (3,014 m) Kapua (2,840 m) Paona (2790 m) and Kapamixu (2430 m). These hills exhibit a remarkable topographic diversity. In general 3 main topographic divisions can be demarckated in the state:

(1) The foolhills with undulating to rolling topography having warm subtropical climate.
(2) The lower ranges and the midslopes with varying degrees of slopes having submontane climate.
(3) High hills and mountainous region above 900 m.

These hills are dissected by a number of seasonal and perennial rivers with more or less 'V' shaped valleys in between. There are 4 major river systems in the state, and these are the Dhansiri, Doyang, Dikhou and Tizu, of these the first three flow towards west through the Assam plains to join the mighty Brahmaputra; while the Tizu river system flows towards east and south-east and pours into Irawadi in Burma.

The Dhansiri river in the south-west corner of the Naga Hills flows a north westerly course and then turns at right angles to the north-east and forms the northern boundary of the district. Doyang river rises near Mao Thana and flows a north easterly course for about 45 miles and abruptly turns to north-west and pierces the main chain of hills. The largest tributary to this river is Rengmapani. The important river in the northern frontier of the state is Dikhu. All these rivers receive a number of tributaries, which are all very small running for only a few miles.

GEOLOGY AND SOIL

Nagaland is located in the Northern extension of the Arakan Yoma ranges which are of tertiary-Cretaceous age, and belong to a fairly young, mobile belt of the earth. The rock sequence is of the geosynclinal facies, represented by the Disang group (Lower and Middle Eocene-upper Cretaceous), the Barail Group (upper Eocene and Oligocene), the Surma and the Tipam Group (Miocene), the Namsang beds (Mio-Pliocene) and the Dihing Group (Pliocene, Pleistocene).

The Disang Group consists of a monotonous sequence of dark grey splintery shales with thin beds of sandstones. There is a gradual upward and also a lateral passage of the Disangs into the Barail Group as indicated by the multiplicity of sandstones near the top of the group. In parts of the Naga Hills, the Disang shales are splintery and sometimes

seaty with numerous thin ramifying quartz veins and a few serpentinised intrusions. The Disang beds are much crumpled and the maximum thickness may be about 3,000 metres.

In Barail Group which is essentially arenaceous is 4,000 to 6,000 m thick and the lowest beds, the Naogaon Formation (equivalent to Laisang Formation of Surma Valley) are mostly well bedded sandstones with shale intercalations. Its division into the Baragalor Formation andthe Tikak Parbat Formation is not feasible in the south-eastern part of the Naga Hills. The Baragoloi Formation and part of the Jenam Formation of the Surma Valley consists of Sandstones and Shales with several coal seams. The overlying Tikak Parbat Formation is similar in lithology, but is marked at its base by thick coal seams having large reserves.

The Surma Group which is essentially an alternation of Shales and sandstones with rare thin Conglomerates, overlies the Barails. The group thins out rapidly northwards.

The Tipam sandstone Group, characterised by ferruginous sandstones in the Naga Hills, attains a thickness of 2,3000 m and this thickness includes the lateral variant of underlying Baka Bil Formation. Still further north-east it is reduced to about 1,000 m.

The Girujan Clay Formation, overlying the Tipam Sandstone Group is characterised by typical blue and mottled clays and argillaceous sandstone beds in the Naga Hills. Some of the

sandy bands in the upper part contain small coal fragments derived from the Barails.

The unconformably overlying Namsang Beds, corresponding to the Dupi Tila Group of the Surma Valley, contain mottled clays, sandstones, conglomerates, grits and coal conglomerate and some lenticular lignite seams. Coal pebbles occurring in the beds have been derived from the Barail Group.

The older Alluvium comprising clay, coarse sand, shingle, gravel and boulder deposits occurring at various levels cover the areas along the North-Western flank of Naga-Patkai ranges and parts of Manipur. The Newer and low level alluvium, comprising clay, sand, silt and shingle covers vast areas bordering the Naga Hills.

3 major structural units have been recognised in the Nagaland-Manipur region. They are (i) the Belt of 'Schuppen' in the North-West bordering the Assam plains (ii) the Patkai synclinorium in the South-East (iii) the Kohima synclinorium in the South.

On the North-Western flank of the Naga hills, the Belt of Schuppen consisting of eight or more overthrusts over riding one above the other forming an inbricate pattern has been found. Along these thrusts the Naga Hills region has moved North-Westward relative to the Foroland spur. The North-Western margin, which for many kilometres, follows the boundary of Patkai ranges is conventionally called the Naga thrust separating the sharply folded sediments of the Belt

of 'Schuppen' from the little affected flat to gently dipping beds lying north of this belt.

The highest ground of the Patkai range synclinorium comprises synclines with Barail rocks, and the relatively open synclines are separated by foulted and over-thrust Disang Shale. On the North-Western fringe of this synclinorium there are a number of thrust planes and dividing lines between the Patkai synclinorium and the 'Belt of Schuppen'.

The Kohima Synclinorium occurs a little to the south-west of Patkai Synclinorium with a little southerly pitch, This synclinorium lies mainly within the Disangs, but towards the Surma Valley higher groups of rocks have been found. It is bounded in the North-West by the Disang thrust and to the south it merges into the eastern end of the Surma Valley.

Nagaland soils are acidic in general and the pH value ranges from 4.8 to 5.62. The organic carbon content of the surface soil is quite high, but the soils are very poor in available phosphate content. The soil texture varies from sandy loam to silty coarse sandy and fine sandy loam. The soils of Nagaland can mainly be grouped under Entisol, Oxisols, Mollisols and Spodosol (Fig. 2).

Entisols are the alluvial soils occurring mainly in the valleys and foothills. These soils are characterised by ochric epipedan, low organic matter and lighter colour. This comprises of the most important soil type for agriculture production.

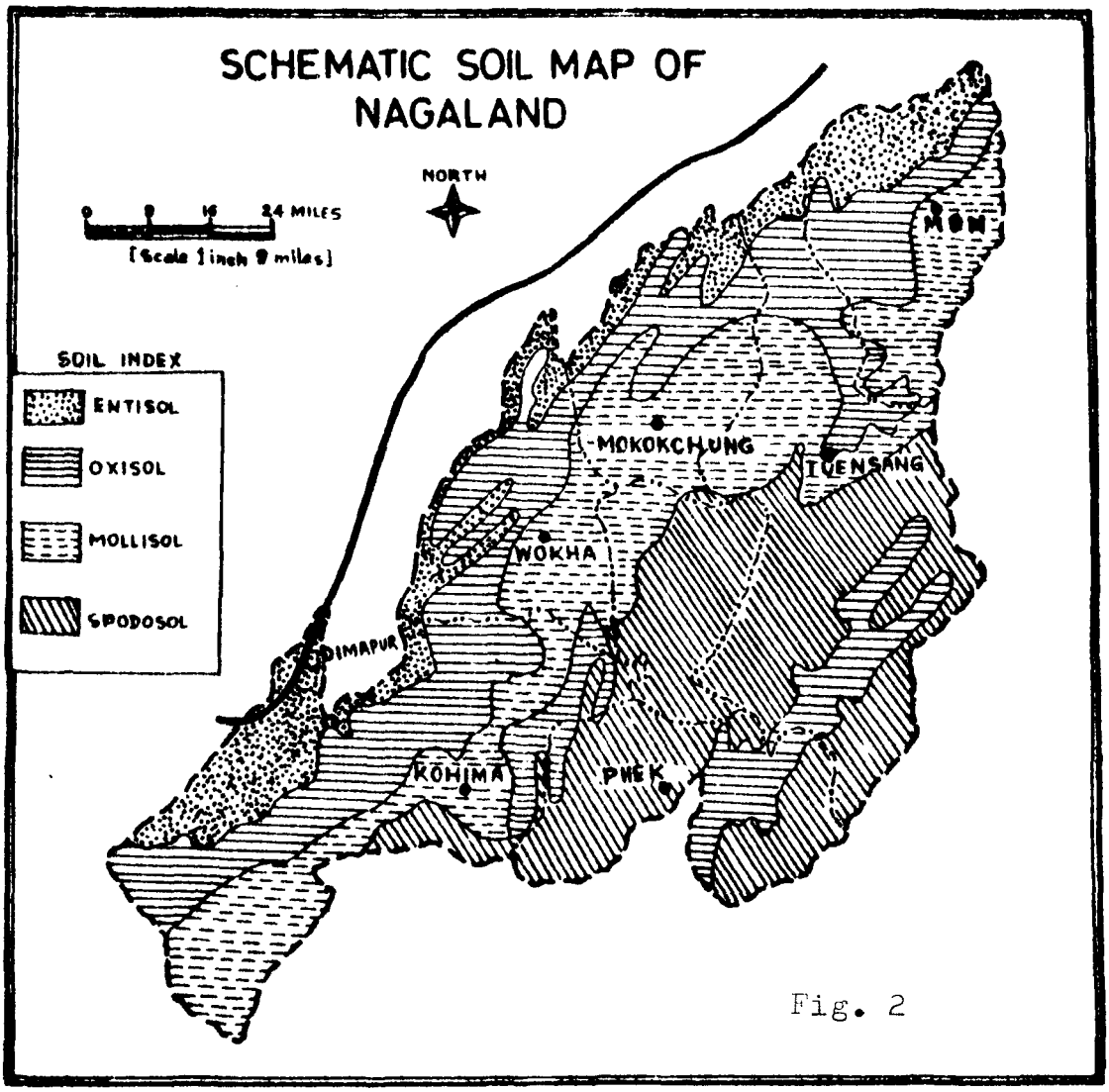
SCHEMATIC SOIL MAP OF NAGALAND
NORTH
0 8 16 24 MILES
[Scale 1 inch 8 miles]
SOIL INDEX
ENTISOL
OXISOL
MOLLISOL
SPODOSOL
MON
MOKOKCHUNG
TUENSANG
WOKHA
DIMAPUR
KOHIMA
PHEK

Fig. 2

Oxisols are strongly weathered, lateritic soils and non laterised latosols, the subsurface horizon of which is characterised by low base exchange capacity, friable and massive structure and accumulation of iron and alluminium. These soils occur mainly over the foothills and lower ranges of the west, more or less upto an elevation of 750 m. These soils have a prolonged day period (rainshadow belt) and are predominantly covered by degraded grass and bamboo forests.

Mollisols occur over cool and temperate areas with temperate rain forests and are characterised by a mollic epipedan, high organic matter and high base saturation.

Spodosols occur over high altitudes with humid and temperate climate, mainly under coniferous vegetation, and are characterised by a subsurface horizon with high cation exchange capacity and high base saturation (Anonymous, 1975).

Since the entire state is hilly, land is prone to soil erosion. There are nearly 6,00,000 hectares of forest cleared areas (Jhumland) which are subjected to severe soil erosion.

CLIMATE

There is such a drastic variation in the climatic conditions, at different altitudinal zones of Nagaland, that it is not possible to make any generalisations with regard to the climate of Nagaland. This fact is clearly reflected in the local distribution of Pteridophytic species in the state.

The climate over the foothills is warm sub-tropical, over midslopes and lower ranges of western flank is moderate, sub-montane type and cool and temperate type over the high hills. The average annual rainfall is between 200 to 250 cms occurring over 7 months from May to October. The bulk of the precipitation is received through south-west monsson during the four months from June to September. There is not a single completely dry month in the year. The average monthly rainfall recorded at different places of the state is appended herewith (Table 1, Fig. 3). The rainy season is characterised by high humidity, and dry spells that occur during the months of July to September are muggy and enervating.

There is also a significant variation in temperature records with respect to different places in the state (Table 2 - 4, Fig. 3). March to June may be said to be the summer months and the advent of summer is characterised by thunder showers and hail-storms, often accompanied by strong wind. The summer temperatures over the hills vary from 5°C to 30°C and those over the foothills have a range between 12°C to 32°C. During winter, large tracts of frost is observed over higher elevations. The winter months (December to March) at the foothills and lower ranges of the hills are characterised by heavy dew fall and misty nights.

The relative humidities (Table 5) are low during summer and higher during rainy months. The monthly mean relative humidities vary from 67% in March to 88% in September and October.

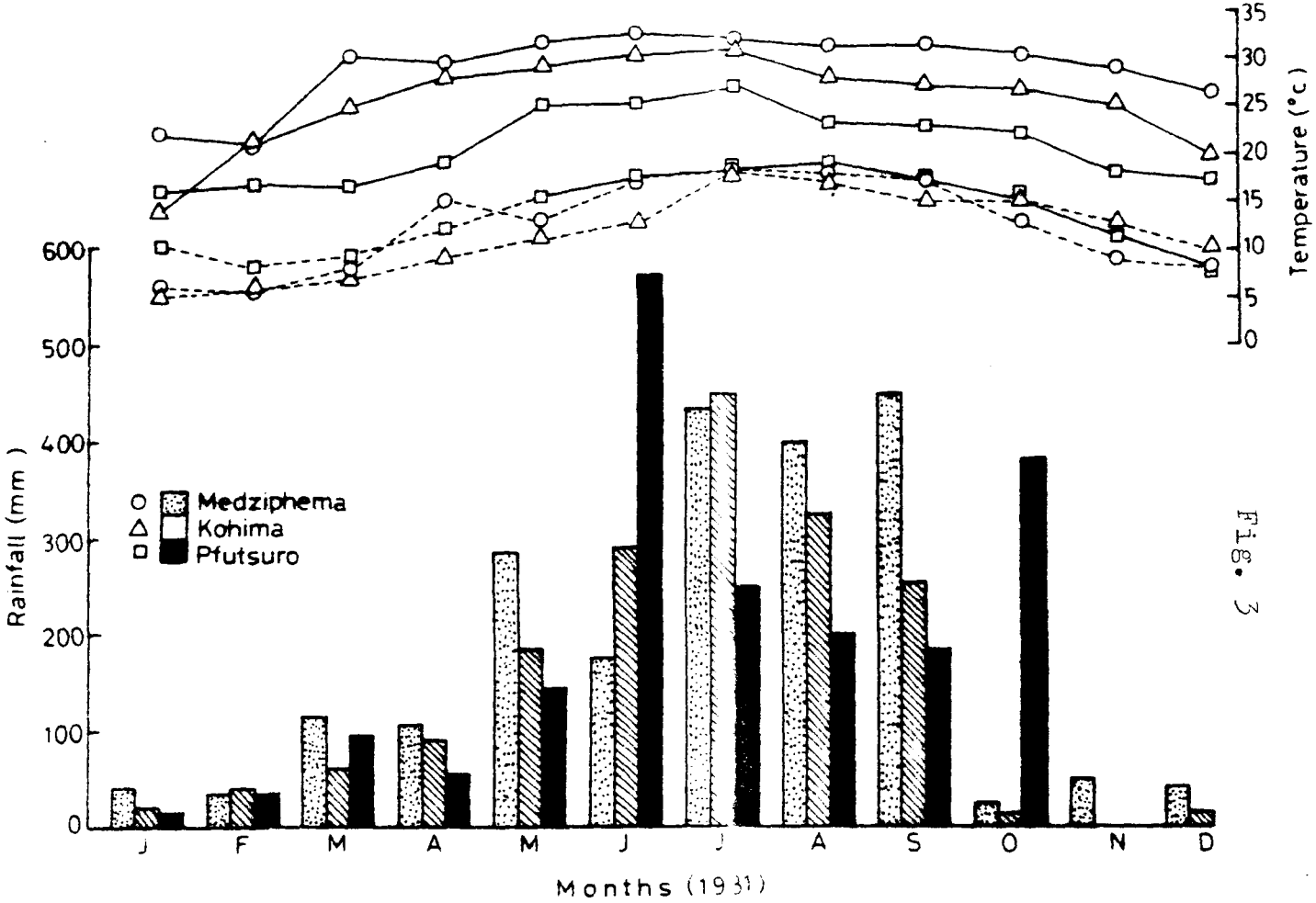
Temperature (°c)
35
30
25
20
15
10
5
0
600
500
400
300
200
100
0
Rainfall (mm)
Medziphema
Kohima
Pfutsuro
J
F
M
A
M
J
J
A
S
O
N
D
Months (1931)

Fig. 3

Table 1: Rainfall (in millimeter) data for 3 different stations in Nagaland.

Months	1979			1980			1981		
	1	2	3	1	2	3	1	2	3
January	Nil	Nil	37.4	9.6	-	Nil	48.2	23.0	7.8
February	4.8	10.7	51.6	66.0	-	3.4	34.8	37.0	34.4
March	95.0	110.9	86.8	144.2	-	29.8	119.8	64.0	98.0
April	96.0	32.0	99.8	110.8	-	47.4	115.8	96.0	56.0
May	54.4	289.0	217.8	458.2	152.0	38.6	281.8	189.0	146.0
June	429.8	-	154.8	574.2	461.4	269.2	175.4	285.7	577.6
July	391.6	391.9	317.2	565.0	349.9	424,8	480.8	489.3	249.6
August	596.2	349.5	264.2	490.6	462.0	266.8	405.8	323.0	202.8
September	226.8	310.6	219.6	467.2	370.6	387.4	457.8	261.2	189.2
October	101.4	-	8.6	376.0	247.0	68.2	30.0	21.6	336.2
November	16.0	-	6.6	1.4	Nil	5.0	45.6	Nil	Nil
December	29.2	-	6.8	Nil	Nil	40	35.2	7.0	Nil

1. Medziphima/Gaspani (500 m)
2. Kohima (1445 m)
3. Pfutsero (2133 m)

Table 2: Temperature records in Degree Centigrade for Medziphima/Gaspani (304 m)

Months	1979		1980		1981	
	Max.	Min.	Max.	Min.	Max.	Min.
January	25.1	12.5	13.7	4.8	22.0	6.0
February	20.9	9.5	26.7	5.3	21.0	5.7
March	22.2	13.1	27.8	6.8	30.0	8.7
April	24.1	15.8	30.5	14.5	29.1	15.6
May	28.3	17.7	30.6	15.1	31.8	13.8
June	31.0	20.2	31.3	6.9	32.3	17.4
July	31.0	20.0	29.9	19.4	32.1	18.6
August	30.4	19.5	32.8	19.0	31.4	18.2
September	28.2	19.1	31.4	18.6	31.6	17.1
October	25.6	15.7	27.5	14.1	30.1	13.1
November	21.9	12.4	27.4	6.3	29.6	9.0
December	24.5	7.1	22.2	7.1	26.4	8.6

Source: Integrated Extension Training Centre, Medziphima Nagaland.

Table 3: Temperature records in degree Centigrade for Kohima (1450 m)

Months	1979		1980		1981	
	Max.	Min.	Max.	Min.	Max.	Min.
January	18.5	5.0	-	-	19.0	5.4
February	20.2	5.0	-	-	21.0	6.0
March	24.5	5.5	-	-	25.0	7.5
April	27.3	12.5	-	-	28.0	9.6
May	30.0	7.8	23.3	18.8	29.0	11.0
June	-	-	30.5	14.5	30.5	13.0
July	29.0	16.3	32.0	16.2	31.0	16.8
August	28.0	16.6	26.7	15.8	28.4	17.5
September	25.5	13.5	26.0	14.5	27.4	15.0
October	-	-	28.1	13.0	27.0	15.0
November	-	6	24.8	13.0	25.0	13.4
December	-	-	23.5	10.0	20.5	10.0

Source: Soil Department, Kohima.

Table 4: Temperature records in Degree Centigrade for Pfutsero (2133 m)

Months	1979		1980		1981	
	Max.	Min.	Max.	Min.	Max.	Min.
January	16.8	3.2	14.1	-	15.9	10.8
February	16.8	5.4	14.7	-	16.2	8.8
March	19.8	10.6	17.9	-	16.5	9.8
April	20.5	13.3	21.8	-	19.1	12.6
May	25.4	15.5	30.3	19.2	25.2	15.2
June	21.8	15.9	21.9	-	25.1	17.9
July	20.6	16.1	34.2	23.3	27.4	18.0
August	21.7	17.4	24.3	18.4	23.3	18.4
September	20.0	16.0	23.5	17.2	23.1	17.7
October	19.3	14.4	19.6	13.9	22.5	15.0
November	14.8	7.7	18.5	11.4	18.0	12.5
December	14.5	-	16.6	8.5	17.9	8.3

Source: Horticulture Research Farm, Pfutsero, Nagaland.

Table 5: Monthly mean Relative Humidities in Percentage for Kohima (at 8.30 hrs).

Months	1979	1980	1981
January	80	-	74
February	66	-	68
March	51	-	67
April	62	-	69
May	71	78	77
June	-	74	81
July	87	85.6	86
August	89	86	83
September	88	88	88
October	-	79	88
November	-	66.4	86
December	-	69	82

GENERAL VEGETATION

FOREST TYPES :

Based on the floristic composition the forests of Nagaland can mainly be divided into 2 groups - Coniferous and broad-leaved forests. Coniferous forests are confined only to Phek and Tuensang districts, bordering Manipur and Burma, while the broad-leaved forests are scattered all over the state. and constitute about 91% of the total forest cover of the state. These broad-leaved forests can again be classified into numerous subtypes depending upon the microclimatic conditions and the altitude. The major subtypes are:

(a) Tropical Evergreen and Semi-Evergreen forests:

These forests are confined to elevations between 200 - 450 m and represent one of the major ecological types in the state with a rich floristic diversity. The western and north-western parts of the state bordering Assam in the west and Arunachal Pradesh in the north and the south-western foothills of the state are covered by this type of forest (Plate 1 & 2). The rainfall is very high and spread over most parts of the year.

There is a bewildering wealth of species in these multi-tiered forests. The top canopy is characterised by some of the important timber species such as Dipterocarpus macrocarpus Vesque, Shorea assamica Dyer, Terminalia myriocarpa Heurch & Muehl., Duabanga grandiflora (Roxb. ex DC.) Walp., Artocarpus

chaplasha Roxb., Michelia champaca Linn., Altingia excelsa Noronha, Amoora wallichii King, Gmelina arborea Roxb., Tetrameles nudiflora R.Br., and a host of others. Some of the upper canopy species show deciduous nature whose leafless nature is very short.

The middle storey is characterised by preponderance of Mesua ferrea Linn., Endospermum chinense Benth., Terminalia spp., Garuga pinnata Roxb., and Toona ciliata Roemer. In moist areas and in valleys often these forests are interspersed by bamboo species such as Dendrocalamus hamiltonii Nees et Arn. and Bambusa tulda Roxb,. In certain semi-evergreen patches this layer is however dominated over by Bischofia javanica Blume, Dysoxylum procerum Hiern., Vatica lanceaefolia Blume and Cyclostemon ellipticus Hook.f.

The lower storey is characterised by Talauma hodgsoni Hook.f. & Th.,Ficus glomerata Roxb., Garcinia sp., Litsaea sp. and a number of smaller trees of the higher storeys.

There is a variety of canes (Calamus spp.) in these semi-evergreen forests specially at the foothills. Apart from the canes numerous shrubs and herbs cover the ground, many of which are quite attractive on account of their showy flowers.

There is a profusion of epiphytic species, specially ferns and orchid species in these forests. Some of the important epiphytic ferns in these forests are Pseudodrynaria coronans (Wall.) Ching, Microsorum punctatum (Linn.) Copel., Pyrrosia nummularifolia (SW.) Ching, P. flocculosa (Don) Ching,

Lepisorus nudus(Hook.) Ching, Polypodium microrhizoma Clarke, ex Bak., P. lachnopus Wall. ex Hook. and Lycopodium spp.

The climatic climax of these forests is being lost in many places due to extensive jhuming (shifting agriculture) and also due to unregulated felling of timber trees (Plate 3).

(b) Tropical deciduous forests:

These forests are met within areas receiving an annual rainfall of about 200 cm and with a varying range of elevation from 400 to 1200 m. The flora is quite diverse here, specially in the lower elevations, where these forests merge with patches of semi-evergreen forests. Though these forests also exhibit multi-tiered nature the different storeys are not quite distinct, as one could see in the case of Evergreen forests. Further, the canopies are very irregular. Some of the important top canopy species are Albizzia procera Benth., A. odoratissima Benth., Terminalia belerica Roxb., T. myriocarpa Mull., Salmalia malabarica (DC,) S. & E., Gmelina arborea Roxb., and others. Schima wallichii (DC.) Korth, one of the important commercial species is also found in great profusion in and around Jalukie area.

The middle and lower storey is predominated over by bamboos belonging to Bambusa tulda Roxb., Teinostachyum dulloa Gamble, and Bambusa arundinaceae Willd. Some of these species form pure patches in certain areas, specially in jhum fallows. Other deciduous species scattered in these patches are Kydia calycina Roxb., Oroxylum indicum Vent.,

Erythrina suberosa Roxb., Emblica officinalis Gaertn., and in Zeliang area the agarwood, Aquilaria agallocha Roxb., one of the important minor forest produce of the state.

The ground cover in these forests consists of several herbs and shrubs, particularly during monsoon. These include apart from flowering plants, a number of terrestrial ferns mostly belonging to genera such as Diplazium, Athyrium, Thelypteris, Cyclosorus, Pteris, Plagiogyria, Pronephrium, and Dryopteris. In disturbed areas Eupatorium odoratum Linn. forms the dominant ground cover.

(c) Temperate forests:

These forests are confined to higher elevations from 1300 to 3500 m. Due to prolonged rains and high humidity the vegetation is quite luxuriant. The top canopy is constituted by commerically important species such as Phoebe cooperiana Kanjilal ex Das, Michelia champaca Linn., Castanopsis indica A. DC., Exbucklandia populnea (Griff.) R. W. Br., Juglans regia Linn., Betula alnoides Ham. and Alnus nepalensis D. Don. The branches of these trees are heavily moss-laden and offer a suitable habitat for a luxuriant growth of epiphytic species, specially orchids and ferns (Plate 4). Some of the important ferns belong to Polypodium amoenum Wall., Loxogramme involuta (Don) Presl., Crypsinus hastatus (Thunb.) Copel., Lepisorus spp., Asplenium spp., Microsorium membranaceum (Bak.) Ching, and Pyrrosia spp. The lower storey is composed of several evergreen species. In general Alnus nepalensis D. Don, Quercus serrata Thunb., Bischofia javanica

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Blume, Magnolia cambelii Hook.f. & Th. and Engelhardtia spicata Blume are common elements. In some places Rhododendron arboreum Smith with their scarlet red flowers are quite conspicuous.

The ground cover is composed of a number of herbaceous species belonging to Impatiens, Strobilanthes and Polygonum. Terrestrial ferns are also too numerous here and chief among them are Arachniodes speciosa (Don) Ching, Coniogramme procera (Wall.) Fee, Microlepia strigosa (Thunb.) Presl., Dennstaedtia scabra (Wall.) Moore, Pteris spp., Asplenium spp., and Dryopteris spp. Climbers are rather rare in these forests.

(d) Subtropical Pine forests:

These forests are distributed in the eastern and south-eastern parts of Tuensang and Phek districts. The elevation varies from 1600 to 2000 m and the average annual rainfall is around 175 cm. Pinus insularis Endl. is the principal element which occurs almost in pure strands (Plate 5). Occasionally broad-leaved species such as Quercus sp. and Schima wallichii (DC.) Korth, are also noticed interspersed among these pines. The forest floor which is covered by a thick mat of litter, supports very little of herbaceous flora, chief among which are Eupatorium spp., and other members of Asteraceae.

(e) Mixed Bamboo forests:

These forests are chiefly confined to old jhum fallows and are mainly formed of Dendrocalamus hamiltonii Nees et Arn.

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Teinostachyum dulloa Gamble, and Bambusa tulda Roxb. The former two species prefer moist localities along streams, while the latter prefers well drained hill slopes. Ferns are rare in these forests except for Pteris spp. which come up gregariously.

Shifting agriculture (jhuming) and its impact on Forests:

The forests in Nagaland constitute only 17.3 percent of the total geographical area, as against 60% of forest area as per National forest policy. This low percentage of forest cover in the state is mainly due to shifting agriculture practised by the local people. Extensive areas of forests are cleared up every year and burnt for shifting cultivation. This has greatly depleted the natural fertility of land and its valuable forest resources, and denuded the potential forest land. Added to this the increase in human population, heavy incidence of grazing and pressure on land for agriculture have also been responsible for removal of forest cover and in turn resulting in barren or only grass and Eupatorium covered hills in the state.

II. PTERIDOPHYTIC FLORA:

The pteridophytic flora of Nagaland is quite rich and interesting on account of their species diversity and peculiar formations. In general, because of the more favourable conditions, at higher altitudes, the pteridophytic flora is mostly concentrated on hills and hill slopes. Marked differences

can also be noticed in the altitudinal distribution of certain individual species. On the basis of their broad habitat, the pteridophytic vegetation may be classified into the following ecological groups:

(a) Epiphytic vegetation: These are species which grow on tree trunks and branches of other trees. While a majority of these species prefer to grow on moist and shady branches and tree trunks in dense evergreen forests, a few others prefer open tree trunks and branches. The composition and density of the epiphytic flora markedly varies with altitude, climatic conditions and the nature of forests.

Epiphytes in low and middle Hill forests (400 - 1200 m):

The epiphytic fern flora in theseforests include Pseudodrynaria coronans (Wall.) Ching, Microsorum punctatum (Linn.) Copel., Asplenium nidus Linn.,A. phyllitides D.Don and others which form huge clumps on tree trunks with creeping fleshy rhizomes, and often with thick humus collecting leaves at their bases looking like nests. The nest forming habit of these species is only to overcome adverse conditions of draught and high intensity. Some of the other epiphytic ferns in these forests are Nephrolepis cordifolia (Linn.) Presl., Vittaria elongata Sw., V. zosterifolia Willd., Pyrrosia nummularifolia (Sw.) Ching, Antrophyum reticulatum (Forst) Kaulf., P. lanceolata (Linn.) Farewell, P. stenophylla (Bedd.) Ching, P. lingua (Thunb.) Farewell, P. mollis (Kuntze) Ching, and these are often associated with fern-allies like Lycopodium squarrosum Forst., L. phlegmaria Linn., etc.

Of these epiphytic ferns in these lowland forests, Nephrolepis cordifolia (Linn.) Presl., is the commonest, which grows on humus-accumulated tree trunks and branches. This species is also recorded in a number of places on humus deposits collected between palm leaf sheaths. Pyrrosia nummularifolia (Sw.) Ching - the commonest of the genus, prefers to grow on exposed, rather dry tree trunks, and at times covering the entire tree trunks, specially in forests around Rangaphar, Changki, and Tijit. The common hosts of these plants are Ficus spp., Artocarpus spp., Alnus spp. and Mangifera sp.

The epiphytic flora gradually changes with increase in altitude and one can normally see above 1200 m the species of Lepisorus nudus (Hook.) Ching, Davallia spp., Pyrrosia flocculosa(D.Don) Ching, Drynaria propinqua (Wall.) J. Sm., etc. on hosts like Quercus sp. and Castanopsis sp. These species possess thick and long-creeping rhizomes, which can overcome the sever winter. During winter most of these ferns shed out their fronds or their fronds get dried and shrivelled up giving the area a dry look, but with the onset of spring their rhizomes become active and produce green fronds and become a conspicuous feature of vegetation again.

Epiphytes of upper Hill forests (1200 - 2300 m):

The forests here are very dense with stratifications. The branches of trees are heavily plastered with mosses and liverworts and provide an ideal substratum for the growth of a number of shade loving ferns. There is also a sort of

stratification exhibited by these epiphytic ferns. Delicate filmy ferns such as Mecodium exsertum Copel., M. javanicum (Spreng.) Copel., Vandenboschia radicans (Sw.) Copel., etc. are quite common on moist moss-covered tree trnks, specially at the base, where they are protected by strong wind, sharp fluctuations in temperature and light. These ferns form a sort of carpet on the tree trunks and overcome the dry months by inrolling their fronds. With the advent of favourable conditions, they again produce green, tender fronds. Besides these delicate filmy ferns Microsorum membranaceum (Bak.) Ching, Ctenopteris subfalcata (Blume) Kuntze, Loxogramme lanceolata (Sw.) Presl., Neocheiropteris normalis (Don) Tagawa are also common at the base of tree trunks. Some of these species also tend to grow as terrestrials on moss covered soils just at the base of tree trunks.

On tree trunks at comparatively open places ferns like Oleandra wallichii (Hook.) Presl., with their long branched, straggling rhizophore-like rhizomes that penetrate into humus deposits are common. Asplenium indicum Sledge, A. tenerum Don, Pyrrosia mollis (Kuntze) Ching, Vittaria elongata Sw., are also frequently met with in open areas.

On the other hand the branches of trees which are thickly clad with dripping festoons of liverworts and mosses support a prolific epiphytic growth of both orchids and ferns. Some of the important ferns are Vittaria elongata Sw.,,Lepisorus loriformis (Wall.) Ching, Loxogramme lanceolata Presl.,

Asplenium ensiforme Wall., and A. nidus Linn. While these are common in shady places, ferns like Polypodium microrhizoma Clarke ex Bak., P. argutum Wall., Lepisorus excavata (Bory) Ching, L. sordidum (C. Chr.) Ching, and Arthromeris lehmanni (Mett.) Ching, reach the top of tree trunks and are tollerant of the sharp temperature fluctuations and strong wind action.

(b) Terrestrials: Approximately 60% of ferns of Nagaland belong to this category. At low land forests (below 1000 m) where the forest floor is rich in humus and organic nutrients ferns like Pronephrium nudatum (Roxb.) Holttum, P. triphyllum (Sw.) Holttum, Diplazium esculentum (Retz.) Sw., Pteris vittata Linn., Christella molliusculus (Wall.) Ching, Bolbitis heteroclita (Presl.) Ching, Colysis hemionitidea Presl., C. pedunculata (Hook. et Grav.) Ching, Leptochilus axillaris (Cav.) Kaulf. and Kaulinia pteropus (Blume) Nayar are very common. While these species occupy the moist, shady places in dense forests, ferns like Pteris biaurita Linn., P. semipinnata Linn., P. quadriaurita Retz., Christella subpubescens (Blume) Holttum, Sphaerostephanos unitus (Linn.) Holttum, Pneumatopteris truncata (Poir.) Holttum, Asplenium bullatum Wall., Diplazium esculentum (Retz.) Sw. and Cyclogramme auriculata (Sm.) Ching and a few others are frequently met with in forest cleared areas and in secondary forests. Along the moist road cutting and in similar situations, one can commonly see Blechnum orientale Linn., and Microlepia speluncea (Linn.) Moore. These species are specially very common at Dimapur, Mon and in Changki. Diplazium esculentum (Retz.) Sw. is another very common fern seen in swampy or marshy areas. The young fronds of this fern are

locally abundantly collected as a leafy vegetable and sold in local markets as "Inchun" or "Asang". Similarly Equisetum debile Roxb. and E. diffusum D. Don are also frequently seen in sandy areas and grassy river banks and often extend to vast areas forming pure patches.

Several species of tree ferns can be noticed in rather exposed areas and in forest margins, specially in Zunheboto, Shamator, Mezenkong, Mon and Changki areas, and form a conspicuous feature of vegetation. These tree ferns belong to Cyathea gigantea (Wall. ex Hook.) Holttum, C. brunoniana (Wall.) Clarke, C. khasiana (Moore ex Kuln.) Domin, C. andersonii (Scott ex Bedd.) Copel. and C. spinulosa Wall. ex Hook. (Plate 9).

At higher elevations (1000 - 3000 m) the fern vegetation is not only quite different but are extremely prolific and include diverse species such as Microlepia strigosa (Thunb.) Presl., M. platyphylla (Don) Smith, M. pilosa (Wall.) Prantl, Dennstaedtia scabra (Wall.) Moore, Arachniodes speciosa (Don) Ching, A. aristata (Forst.) Tindale, Polystichum biauristatum (Blume) Moore, Diplazium muricatum AvR, Coniogramme fraxinea (Don) Diels, Colysis elliptica (Thunb.) Ching, C. pothifolia (Ham. ex Don) H.Ito and a number of Dryopteris, Athyrium and Asplenium species. Tree ferns belonging to Cyathea spinulosa Wall. ex Hook. and C. brunoniana (Wall.) Clarke et Bak., are also not uncommon in these forests. Large ferns like Diplazium asperum Blume, D. maximum (Don) C. Chr., D. spectabilis (Wall. ex Mett.) Bir, Dryoathyrium boryanum (Willd.)

Ching, Athyriopsis japonica (Thunb.) Ching and Cibotium baromtez (Linn.) J. Smith make the sl opy ground vegetation conspicuous in the high forests. On the other hand the open places and the road sides of these hills are luxuriantly covered by Sphenomeris chinensis Maxon, Dryopteris cochleata (D.Don) C.Chr., Hypolepis punctata (Thunb.) Mett., Pteris spp., Selaginella chrysocaulos (Hook. et Grev.) Spring, S. monospora Spring, and S. involvens (Sw.) Spring. Some of these species also form a characterestic feature of vegetation of streams, waterfalls and river banks on hills. Occasionally Angiopteris evecta (Forst.) Hoffm. is also noticed in these situations, specially in shady areas.

There are several associations of ferns at 1500 - 2000 m elevation, and these are Cyclosorus parasitica (Linn.) Farewell Peranema cyatheoides D. Don, Plagiogyria communis Ching and Pseudophegopteris aurita (Hook.) Ching association and association of Gleichenia longissima Blume, Thelypteris nipens (Hope) Ching, and Dryopteris paleaceae (Moore) Fomin, Pteridium aquilinum (Linn.) Kuhn and Dicranopteris linearis (Burm.f.) Underwood. The latter association often forms impenetrable thickets in open grasslands and along forest margins. Most of these ferns are robust and possess very tough and hard rhizomes and stipes, and therefore can withstand either high intensities of temperature or sever cold of winter.

(c) Climbers:

There are only four climbing species of ferns in the pteridophytic vegetation of Nagaland viz., Stenochlaena palustris (Burm.) Bedd., Lygodium flexuosum (Linn.) Sw., L. japonicum (Thunb.) Sw., at lower elevations (below 1000 m) and Microsorum superficiale (Blume) Ching, at higher elevation (1200 - 2000 m) These species prefer to grow on rich humus soil and reach very great heights on other trees. Of these Lygodium flexuosum (Linn.) Sw. and L. japonicum (Thunb.) Sw. are quite dominant in Rangaphar, Changki valley and Tijit areas; while Stenochlaena palustris (Burm.) Bedd. with their dimorphic fronds are rather rare. The rhizome of this species is quite strong and quill-like and climbs over large trees with the help of clasping roots. Microsorum superficiale (Blume) Ching, is a shade-loving species common in dense evergreen forests; the rhizome of this species is firmly adpressed to host plants by clasping roots.

(d) Ferns that grow on rocks and boulders (Lithophytes):

Numerous species are found growing on rocks and boulders and mainly two categories can be recognised under this viz., species growing on exposed rocks and rock-crevices and species that grow on moss-covered rocks in dense forests, specially near water courses. Under the former category, Cheilanthes farinosa (Forsk.) Kaulf, C. albomarginata Clarke, C. tenuifolia (Burm.) Sw., Onychium siliculosum (Desv.) C. Chr., Pityrogramma

calomelonas (Linn.) Link, Adiantum capillus-veneris Linn., Humata repens (Linn.f.) Diels, Colysis pothifolia (Ham. ex D. Don) H.Ito, Asplenium spp., Selaginella spp., Lindsaea himalaica Kramer, Ariostegia pulchra Don, and a few others. These species can withstand high summer temperatures, when most of their fronds dry up covering their rhizomes and giving a dry look, but with the receiving of premonsoon showers these ferns put forth young, green fronds and become conspicuous again.

The rocks and boulders lying inside dense forests and near streams support altogether a different group of ferns. The prolific growth of mosses and liverworts on these rocks support a number of filmy ferns such as Vandenboschia radicans (Sw.) Copel., Mecodium javanicum (Spr.) Copel., M. exsertum (Wall. ex Hook.) Copel., M. polyanthos (Sw.) Copel. and species of Asplenium and Adiantum.

(e) Aquatic and marshy ferns: (Hygrophilous vegetation).

The hygrophilous vegetation along the banks of streams, ravines, waterfalls, etc. is quite rich and include, apart from numerous angiospermic plants, a wide variety of Pteridophytic species. There are some ferns which prefer to grow along the water courses on hill slopes, especially on calcareous soils. These include Diplazium polypodioides (Mett.) Blume, D. bellum (Clarke) Bir, D. maximum (D.Don) C. Chr., D. esculentum (Retz.) Sw., Pronephrium nudatum (Roxb.) Chandra, P. lakhimpurense (Rosenst.) Holttum, Tectaria vasta (Blume)

Copel., T. polymorpha (Wall. ex Hook.) Copel., Coryphopteris viscosa (Baker) Holttum, Ampelopteris prolifera (Retz.) Copel., Diplaziopsis japonicum (Blume) C. Chr. In certain shady places one can commonly see pure patches of Selaginella species

Among the true rooted aquatics mention can be made of Marsilea quadrifolia Linn. and Ceratopteris thallictroides (Linn.) Brongn., which are common at lower elevations (250 m) in paddy fields, swamps and in stagnant waters.

There are only two free-floating aquatic ferns in Nagaland and these are Salvinia natans (Linn.) All. and Azolla pinnata R. Br. Both these ferns are common in lower elevations in Dimapur and Tijit valley, where these species are found extensively spreading over the whole surface of water. Azolla pinnata R. Br. has also been rarely noticed in paddy fields at higher elevations of Kohima (1000 m).

EARLY HISTORY OF BOTANICAL COLLECTIONS IN NAGALAND:

A survey of literature on botanical collections in Nagaland reveals a distinct lacuna in the study of plants. The earliest person who has made some remarks on the botany of Naga Hills seems to be William Rabinson who was an educationist of the Assam Government Seminary. Rabinson's (1941) descriptive account of Assam, in fact is one of the first of the gazetteers devoting chapters to climate, geology, Botany, Zoology and even the Anthropology of the area.

Masters (1844) who was at that time the superintendent of Hon'ble company's Botanical Garden at Calcutta (now Indian Botanic Garden), has made a number of collections, while passing over the first ranges of Naga Hills, lying between the Dikho and Dhansiri rivers. He has also made certain curious observations on the flora, the people and their way of cultivation. At one place he remarks "The flora of this portion of the hills resembles in a great measure, that of the more elevated parts of the plains ... still I met with many plants which I have never seen in the plains and some of those which I have seen down here are evidently not at home". Further he remarks "I presume it would occupy an experienced Botanist 10 years to explore the whole Naga Hills, from the Booreedihing to the Dhunsiri, in a satisfactory manner, none of them having been hitherto visited by any Botanist". These remarks testify the peculiarities and richness of the flora covering these hills. Masters (1848) has also published an account of the vegetable productions of the Naga Hills.

C. B. Clarke who was a mathematician by training seems to be the greatest Botanical collector of the century from this area. As Inspector of Schools in Assam, he has surveyed vast areas and made a large number of collections, which are now deposited in Kew herbarium (K) with a duplicate set in Calcutta Herbarium (CAL). In his (Clarke, 1889) account on the plants of Kohima and Munneypore, he has listed 1050 species of flowering plants and ferns collected on a march

from Golaghat via Kohima and Munneypore to Cachar in October November 1885. He has dealt in this 22 genera and 76 species of Pteridophytes collected mainly from Hills. Further, C.B. Clarke (1886) in a letter to Hooker expresses his surprise by the marked difference at comparable altitudes of the flora of Naga Hills from that of Khasi Hills. He concludes "Nearly all plants that grow both in Sikkim and Khasia grow here ... the Sikkim plants altogether predominate in number of individuals and make Kohima resemble Darjeeling, not Shillong". Similarly he says that the ferns of this region are quite similar to ferns of Sikkim.

Dr. Watt, a contemporary of C.B. Clarke has also made some collections almost from the same route as that of Clarke's and all collections of Watt are deposited in Kew and have not been published subsequently. Most of the collections of Clarke were also studied by Hooker (1872-97) for his Flora of British India.

The botanical explorations and floristic studies in Naga Hills for the next few decades were undertaken by the forest officers of Assam. Gustav Mann who was posted as Conservator of forests in Assam during 1863 - 81 made extensive collections of plants from the whole of Assam and mainly from Khasi and Jaintia Hills. His collections are now deposited in Kanjilal's Herbarium of Botanical Survey of India (ASSAM). Following Gustav Mann, U. N. Kanjilal, also

a forest officer, made extensive collections from the whole of Assam with a view to publish a regional flora of Assam, which of course, was seen through the press by his son P.C. Kanjilal and his colleagues A.Das, C. Purkayastha and R.N.De, who were all forest officers in Assam Government.

Publication of the flora of Assam (Kanjilal et al., 1934-40) forms a landmark in the history of botanical studies in this region, but yet this flora created an obvious gap in the study of Monocots and ferns, a knowledge of the latter being very meagre even today.

N.L.Bor, a British Botanist during his tenure as a Forest officer in Assam, has also made substantial collections particularly of grasses from this region. In his (Bor, 1942) remarks on the geology and flora of Naga and Khasi hills also expresses the earlier view of Clarke (1886) about the similarity of the Naga Hills flora with that of Sikkim, about 800 km away than that of Khasi Hills flora, which is only 160 km away.

While most of the above workers concentrated on collection and study of flowering plants, at least two persons, R.H. Beddome and C.B. Clarke have made substantial contributions to the ferns of the Indian subcontinent as a whole. While C.B.Clarke (1880) published his 'A Review of ferns of Northern India' based on collections for about eleven years from Kashmir to Chittagong and eastwards, R. H. Beddome

published in 1865 - 70 his 'Ferns of British India, Ceylon and the Malaya peninsula (1883). These monumental works included a number of specimens from the present Nagaland also.

With the reorganisation of the Botanical Survey of India in 1956, a separate regional Circle was set up in Shillong to explore the botanically rich areas of N.E. India, and although, since then various officers of the Survey have made extensive collections from various parts of N.E. India, the state of Nagaland remains almost unexplored as far as the Pteridophytic flora is concerned.

Nevertheless, a few ethnobotanical accounts of Nagaland have also been published (Rao and Jamir, 1981,1982) and these again are mainly concerned with flowering plants.

After the monumental publications of Beddome (1885-70; 1883, 1892) and Clarke (1880) the only worthwhile accounts of the pteridophytic plants of the earlier Assam (including Naga Hills) are those of Panigrahi (1960) and Kachroo (1953, 1975). Panigrahi (1960) has enumerated 350 species of pteridophytes. His collections are also deposited in the Kanjilal Herbarium of the Botanical Survey of India (ASSAM). A few monographic or revisionary accounts on certain families/ genera of Pteridophytes from the Indian subcontinent have been published (Alston, 1931; Balakrishnan et al., 1960; Bir, 1962; Panigrahi and Dixit, 1966, 1967, 1969, Dixit and

Panigrahi, 1969a; Bir and Trikha, 1974; Dixit and Das, 1977, 1981) which also include collections made from this region.

PRESENT STUDY:

1. Field and Herbarium methods:

The present flora deals with an account of pteridophytic plants and is based on extensive collections made regularly from several localities in different parts of the state of Nagaland. These areas (cf. map of Nagaland showing places of collection) were visited periodically for about 3 years continuously.

In the field, while collections, elaborate notes particularly on the habit, habitat, size of fronds, colour of scales if present, nature of rhizome and indusium where present (from young sori) were made in the field note book. Commonly associated species and in case of epiphytes the host trees (where known) were also noted. Where possible, the whole plants including the rhizome were collected, but in case of arborescent and other larger ferns the approximate size of the trunk, fronds, and the nature of rhizome were noted, along with collection of portions of these.

In general, collection, pressing and preparation of Herbarium specimens follow the recommended procedures (Jain and Rao, 1976).

All the specimens collected are deposited in the Herbarium North-Eastern Hill University, Shillong (NEHU*) with a nearly complete duplicate set in the Herbarium of Punjabi University, Patiala (PUN).

Provisional identifications were made with the help of available literature and were latter determined in various Herbaria (ASSAM, CAL, PUN).

The Flora:

In presenting the flora, the families and genera under each family are arranged according to Pichi-Sermolli's (1977) classification, with minor changes (splitting or lumping of genera in certain cases). In case of Thelypteridaceae however, the arrangement of various genera follows Holttum (1971).

Taxonomic treatment includes an artificial key to Families genera and species under each family, along with detailed descriptions for these. In general the keys and the descriptions refer to the collections from Nagaland. Citations of genera and species include only those important synonyms which have a relevance to Indian works, including some monographs and revisions.

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* The abbreviation 'NEHU' for the Herbarium of North-Eastern Hill University is only tentatively proposed here and has not been listed in 'Index Herbariorum'.

An attempt has also been made to check the nomenclature of the species with the literature available to the author.

The total number of genera and species mentioned under each family is based on the information from Pichi Sermolli (1977), DeVol (1980), Copeland (1947), Nayar (1974) and others, and is subject to change.

The illustrations provided for most of the species are based on some voucher specimens deposited in the Herbarium.

Under distribution only names of countries are shown by CAPITALS, while states, regions are also mentioned within India.

At the end of each species an exiccata or Herbarium specimens examined from Nagaland is mentioned.

CONCLUSION

Nagaland presents a rich and diverse Pteridophytic flora mainly because of the varying elevations, coupled with the tropical to temperate climate prevailing over the state. Therefore, both tropical and temperate ferns grow luxuriantly in this state. In the present work, based on four years field collection and study of flora, 302 species belonging to 101 genera and 40 families are delt, following Pichi Sermolli's (1977) classification (Table 6), except for Thelypteridaceae which follows Holttum (1971). Four new species, Crypsinus nagalandensis sp. nov. Polystichum birii sp. nov., Bolbitis nagalandense sp. nov. and Cyathea holttumiana sp. nov., and two new varieties Tectaria polymorpha (Wall.ex Hook.) Copel. var. trifida var. nov. and Polypodium argutum var. longifolia var.nov. are described in this work. Besides, a number of new distributional records which have not been mentioned in existing literature (Panigrahi, 1960; Rao, 1963; Mehra and Bir, 1964; Iwatsuki, 1975; Nair and Dixit, 1981; Baishya and Rao, 1982) are also reported (Table 7). The new taxa described in the thesis are only tentatively proposed and their valid publication is being taken up separately.

The present account forms the first and only nearly a complete Pteridophytic flora of the state, as further explorations, particularly to areas like Tuensang and Mon,

Table 6: PTERIDOPHYTIC FLORA OF NAGALAND

Families (After Pichi-Sermolli, 1971)	Genera	Species
1. Lycopodiaceae	1	7
2. Selaginellaceae	1	15
3. Equisetaceae	1	2
4. Botrychiaceae	1	1
5. Ophioglossaceae	1	1
6. Angiopteridaceae	1	1
7. Osmundaceae	1	1
8. Plagiogyriaceae	1	4
9. Gleicheniaceae	2	4
10. Grammitaceae	1	1
11. Loxogrammaceae	1	3
12. Polypodiaceae	16	53
13. Dipteridaceae	1	1
14. Lygodiaceae	1	2
15. Sinopteridaceae	1	4
16. Cryptogrammaceae	1	2
17. Pteridaceae	1	10
18. Adiantaceae	1	3
19. Hemionitidaceae	2	7
20. Vittariaceae	2	4

21. Parkeriaceae	1	. . .	1
22. Marsileaceae	1	. . .	1
23. Hymenophyllaceae	5	. . .	9
24. Dicksoniaceae	1	. . .	1
25. Cyatheaceae	1	. . .	7
26. Dennstaedtiaceae	3	. . .	14
27. Hypolepidaceae	3	. . .	3
28. Lindsaeaceae	2	. . .	4
29. Thelypteridaceae	15	. . .	31
30. Aspleniaceae	1	. . .	17
31. Athyriaceae	5	. . .	21
32. Aspidiaceae	11	. . .	43
33. Lomariopsidaceae	2	. . .	5
34. Elaphoglossaceae	1	. . .	1
35. Nephrolepidaceae	1	. . .	2
36. Oleandraceae	1	. . .	1
37. Davalliaceae	5	. . .	11
38. Blechnaceae	2	. . .	2
39. Azollaceae	1	. . .	1
40. Salviniaceae	1	. . .	1
	40	101	302

Table 7: New distributional records of Ferns for Nagaland (Species alphabetically arranged).

Name of the species	Earlier records	Present record in Nagaland
Arachnioides membranulosa	Nepal, Yunan, N. Thailand; India - Himalayas, Kumaon.	Phek (Phek dist., 1200 m)
Asplenium bullatum	Nepal, Tonkin, S.W. China, Formosa; India Himalayas (Darjeeling)	Kohima (Kohima dist., 1445 m).
A. decrescens	India - Nilgiri	Changki (Mokokchung dist., 1000 m)
A. paradoxum	Penang, Java, Sumatra, Malaya, India.	Changki (Mokokchung dist., 1000 m)
A. perakense	Malaya, China, Japan, Jhelum valley, India-Kashmir.	Nezenkong forests (Mokokchung dist., 1326 m).
A. sarelii	China, Japan, India-N.W. Himalayas.	Embai forests/ Peren (Kohima dist., 1446 m).
Athyrium dentigerum	Nepal, Bhutan, India-Himalayan regions.	Kohima (Kohima dist., 2000 m).
A. thelypteroides	Bhutan, N. America, Canada, India - Himalayan region.	Japvo hills (Kohima dist. 2400 m).
Ctenitis apiciflora	Nepal, China, Taiwan, India- Darjeeling.	Pulebadze (Kohima dist., 1800 m).
C. parishii	Malaya, Burma, Siam, India.	Phek (Phek dist., 1200 m).
Cystopteris fragilis	Tropical America, Europe, Tibet, Japan, N. Asia, India - Himalayas.	Rangapar forest (Kohima dist., 250 m).

Dennstaedtia appendiculata	Nepal, India-Darjeeling, Sikkim.	Changki (Mokokchung dist., 1000 m).
Diplazium muricatum	Srilanka, N.Thailand, S.W. China, Formosa, Java, India-Himalayas (Darjeeling).	Wokha (Wokha dist., 1300 m).
D. squamigerum	China, Taiwan, Japan, India-North India, (Jammu & Kashmir).	Morong forests (Tuensang dist., 2134 m); Japvo hill (Kohima dist., 2100 m).
Dryopteris fructuosa	India -Lachon valley, North-Sikkim.	Zunheboto (Zunheboto dist., 1875 m).
Gonocormus minuta	Malaya, Siberia, China, Taiwan, Japan, Philippines, Indonesia, Afica, Java, Srilanka, S.India, Nilgiri hills.	Tijit (Mon dist., 200 m).
Lepisorus kashyapii	N. W. Himalayas.	Phek (Phek dist., 1200 m).
L. oligolepidus	Burma, China, Japan, India-W. Himalayas (U.P.)	Morong forests (Tuensang dist., 2136 m).
L. thunbergianus	China, Japan, Taiwan, Philippines, India - N.W. Himalayas.	Kohima (Kohima dist., 1445 m); Peren (Kohima dist., 1446 m).
Onychium japonicum	Burma, Pakistan, China, Japan, Korea, Taiwan, Philippines, Java, Nepal, India-Darjeeling, N.W. India.	Kohima (Kohima dist., 1445 m); Morong forest (Tuensang dist., 2100 m); Changki (Mokokchung dist., 1000 m).
Ophioglossum petiolatum	Nepal, Tropics and temperate regions, world wide India - U.P and M.P.	Nagaland Kohima Science college campus 1500 m.

Pneumatopteris truncata	Srilanka, China, Malaya, Philippines, Polynesia, Australia, Taiwan, India - South and North India.	Changki (Mokok-chung dist., 1000 m).
Polystichum lonchipinnule	Nepal, India-Darjeeling, Himalayas, South India.	Changki (Mokok-chung dist., 1000 m)
P. prolificans	Malaya, Sumatra.	Japvo Hill (Kohima dist., 2400 m); Changki (Mokok-chung dist., 1000 m new record for India.
P. setiferum	India - N. Wetern Himalayas	Phek (Phek dist., 1200 m).
Pronephrium glandulosum	Java, Malaya, Sumatra.	Changki Tziilu (Mokokchung dist., 250 m). A new record for India.
Pseudophegopteris pyrrhorhachis	Africa, Asia, Malaya, Polynesia Hawaii, India -Himalayas region.	Shamator (Tuensang dist., 1690 m).
Sphaerostephanos heterocarpum	Burma, China, Malaya, Srilanka, Taiwan, India -South India.	Kohima (Kohima dist., 1445 m).
Thelypteris xylodes	Nepal, India -South India - Nilgiri hills, North-Western Himalayas.	Changki (Mokokchung dist., 1000 m); Kohima (Kohima dist., 1445 m).

which are not easily accessible at present, are sure to yield many more additions, including probably many taxa which are either underscibed or new records for India.

A comparison of the five dominant families of Pteridophytes (Table 8) in Meghalaya (Baishya and Rao, 1982), Darjeeling and Sikkim (Mehra and Bir, 1964), and N.W. Himalayas (Dhir, 1980) with the present work shows that Polypodiaceae is the largest family in the north-eastern region, while its position becomes third in N.W. Himalayas, which is comparatively drier. Similarly, Aspidiaceae and Athyriaceae occupy more or less the same positions in the Pteridophytic flora of these regions. Pteridaceae which is the fifth dominant family in Sikkim and Darjeeling, however, do not find a place in other three regions. Further, it is observed that the total number of species in the entire N. W. Himalayas (Dhir, 1980) is much less (71 genera and 264 species) compared to N.E. region. This may be primarily due to the heavy rainfall and high humidity spread over most parts of the year in N.E. region.

The two great British Botanists, (Clarke, 1886; Bor, 1942) remark that the flora of Naga Hills have a closer similarity with the flora of Sikkim, about 800 km away, than with the flora of Meghalaya which is only 160 km away. Their observation is mainly based on flowering plants. A comparison of the pteridophytic flora of Nagaland with that

of Meghalaya (Baishya and Rao, 1982) and Darjeeling and Sikkim (Mehra and Bir, 1964) reveals 68 percent of Nagaland flora common to Meghalaya, while 65 percent common to Sikkim and Darjeeling. Therefore it may be concluded that the distribution of pteridophytic flora, unlike flowering plants, follows more or less uniform pattern throughout these north-eastern hills.

It is observed in this work that the terrestrial species constitute more than 50 percent (170 species) of the total flora, while the epiphytes constitute 1/3 (100 species) of the total flora (Table 9). More than 90 percent of these species are exclusively collected from dense natural forests, and any disturbance therefore, to these natural forests results in the elimination of a number of these species from the area. This last, is what is happening in the state in an accelarated phase during these years. Extensive areas are being clear-felled and burnt every year by the tribal populations for shifting cultivation (jhuming). Further, the numerous and intensive programmes of development in this region have also largely cleared many ideal habitats for pteridophytes. But unfortunately, there is no assessment of the loss or damage caused to the flora, in the absence of any authentic data on the flora of the state. The present work, therefore is hoped to enthuse botanists to take up this challenging task of bringing out a full flora of the state of Nagaland, before many useful, indigenous species totally disappear from the area.

Table 8: Comparison of five dominant families in N.E. Himalayas (Duir, 1980), Darjeeling and Sikkim (Mehra and Bir, 1964), Meghalaya (Baishya & Rao, 1982), and in the present study.

N. E. Himalayas	Darjeeling and Sikkim	Meghalaya	Present study
1. Athyriaceae (4:14)	Polypodiaceae (14: 61)	Polypodiaceae (23:51)	Polypodiaceae (16:53)
2. Aspidiaceae (8:39)	Athyriaceae (6:47)	Dryopteridaceae (6:21)	Aspidiaceae (11:43)
3. Polypodiaceae (8:38)	Aspidiaceae (9:46)	Thelypteridaceae (10:20)	Thelypteridaceae (15:31)
4. Thelypteridaceae (7:22)	Thelypteridaceae (4:30)	Aspleniaceae (1:14)	Athyriaceae (5:21)
5. Aspleniaceae (2:19)	Pteridaceae (1:21)	Adiantaceae (5:14)	Aspleniaceae (1:17).

Table 9: Ecological classification of Pteridophytes of Nagaland.

	Categories	Families	Genera	Species
1.	Terrestrials	23	59	180
2.	Epiphytes	8	31	101
3.	Lithophytes	5	7	17
4.	Aquatic	4	4	4
	Total	40	101	302

TAXONOMIC TREATMENT

K E Y T O F A M I L I E S

1a. Leaves microphyllous; sporangia borne in strobili or in the axils of leaves.

2a. Sporophytes articulate with nodes and internodes; internodes with distinct grooves and ridges; leaves scaly, whorled at each node; sporangia on the undersurface of stalked, peltate sporangiophores; antherozoides multiciliate . . . . . 3. EQUISETACEAE

2b. Sporophytes not articulate; leaves well developed; sporangia either in the axils or on the adaxial surface of sporophylls; antherozoides biciliate:

3a. Vegetative leaves in 4 rows; spores of 2 kinds, mega and microspores .2. SELAGINELLACEAE

3b. Vegetative leaves spiral or decussate; spores of one kind . . . . . 1. LYCOPODIACEAE

1b. Leaves megaphyllous; sporangia on ordinary fronds or in sporocarps.

4a. Aquatic or marshy plants; sporangia in tough, bean-shaped sporocarps.

5a. Free-floating plants; leaves not 4-lobed.

6a. Sporocarps in bunches; leaves highly dimorphous, one type green and floating and the other finely dissected and rust-like, submerged.. .... 40. SALVINIACEAE

6b. Sporocarps in pairs; leaves minute imbricating, 2-lobed, upper emergent and lower submerged . . . . . 39. AZOLLACEAE

5b. Rooted in marshy places; leaves distinctly 4-lobed . . . . . 22. MARSILEACEAE

4b. Terrestrials or epiphytic (rarely marshy); sporangia on the abaxial surface of fronds.

7a. Sporangial walls more than 1-celled in thickness; annulus absent, dehiscing by a slit into 2 valves . . . (EUSPORANGIATAE)

8a. Fronds fleshy, caudex erect, short, surrounded by a basal sheath; roots fleshy; leaves divided into a fertile panicle or spike-like segment and simple or pinnatifid sterile segment; circinate vernation absent.

9a. Sterile segment simple, entire; veins anastomosing; fertile segment a simple spike 5.OPHIOGLOSSACEAE

9b. Sterile segment decompound; veins free; fertile segment paniculate . . . . . 4. BOTRYCHIACEAE

8b. Fronds otherwise; caudex erect or prostrate, not surrounded by basal sheaths; roots not fleshy; leaves not divided into sterile and fertile segments; sporangia marginal, superficial; circinate vernation present . . 6.ANGIOPTERIDACEAE

7b. Sporangial walls 1-cell in thickness; annulus well developed (absent in Osmunda); dehiscence various . . (LEPTOSPORANGIATAE)

10a. Aquatic or marshy ferns; fronds bi-tripinnatifid, more or less dimorphous, sori marginal, covered by reflexed lamina . . . . 21. PARKERIACEAE

10b. Terrestrial or epiphytes; fronds and sori various.

11a. Sori ex-indusiate.

12a. Sporangia not in sori, borne singly on the margin of fertile segments; annulus absent . . . . 7. OSMUNDACEAE

12b. Sporangia in sori; annulus present.

13a. Sporangia not acrostichoid.

14a. Sori superficial.

15a. Fronds fan-shaped, deeply cleft into 2 halves, each part dichotomously lobed; sori numberous, round . . . . . 13. DIPTERIDACEAE

15b. Fronds not as above.

16a. Fronds simple, pinnatifid or rarely pinnate.

17a. Fronds pseudo-dichotomously, repeatedly forked with a dormant bud at the forkings . . . . . 9. GLEICHENIACEAE

17b. Fronds otherwise.

18a. Epiphytes; stipe and margin of fronds hirsute . . . . . 10. GRAMMITACEAE

18b. Epiphytes or terrestrials; stipe and fronds hot hairy . . 12. POLYPODIACEAE

16b. Fronds bipinnate or decompound; fronds covered by unicellular hairs . . . . . 29. THELYPTERIDACEAE (Cyclograma, Ampelopteris)

14b. Sori in grooves or immersed; (if rarely superficial, then sori forming linear coenosori).

19a. Sori linear, confluent.

20a. Linear sori oblique to costa.

21a. Fronds pinnate . . . . 19. HEMIONITIDACEAE

21b. Fronds simple . . . . . 11. LOXOGRAMMACEAE

20b. Linear sori marginal or parallel to margin . . . . . 20. VITTARIACEAE

19b. Sori round.

22a. Veins anastomosing, or, if free, fronds not hairy . . . 12. POLYPODIACEAE

22b. Veins free; fronds hairy . 10. GRAMMITACEAE

13b. Sporangia acrostichoid; fronds dimorphic.

23a. Indusium rudimentary; stipe with aerophores at base. . . . . 8. PLAGIOGYRIACEAE

23b. Indusium well developed; stipe without aerophores.

24a. Epiphytes; fronds simple, veins parallel . . . . . 34. ELAPHOGLOSSACEAE

24b. Terrestrials; fronds pinnate; veins reticulate . . . . . 33. LOMARIOPSIDACEAE

11b. Sori indusiate.

25a. Fronds wiry, much twining or climbing; sporangia solitary, borne in tufts (Sorophore) . . . . . 14. LYGODIACEAE

25b. Fronds otherwise; sporangia on receptacles.

26a. Fronds small, filmy, 1-cell in thickness; sporangia borne on extended veinlets; indusia tubular, or 2-lipped . . . . . 23. HYMENOPHYLLACEAE

26b. Fronds otherwise, robust; sporangia not borne on extended veinlets; indusia otherwise.

27a. Rhizome erect; trunk massive; fronds large, tripinnate; rhizome and stipe clothed with long, dense, golden brown hairs; indusium 2-lipped . . 24. DICKSONIACEAE

27b. Rhizome erect or prostrate; trunk not massive; fronds various; rhizome and stipe not clothed by such hairs; indusium not 2-lipped.

28a. Sori terminal on single, marginal veins.

29a. Sori at the base of a cup, close to edge of lamina. . . . . .26. DENNSTAEDTIACEAE

29b. Sori protected by indusia or edge of lamina.

30a. Stipes articulate on rhizome.

31a. Fronds decompound; pinnae not jointed to rachis; indusia tubular, cup-like or scale-like . 37. DAVALLIACEAE

31b. Fronds simple or pinnate; pinnae jointed to rachis; indusia round, reniform.

32a. Rhizome creeping; fronds simple; sori in a close row on either side of the midrib . . 36. OLEANDRACEAE

32b. Rhizome suberect; fronds pinnate; sori submarginal on pinna lobes . . . . 35. NEPHROLEPIDACEAE

30b. Stipe not articulate.

33a. Fronds tufted; costae and costules raised; indusium minute or absent . . . . . 32. ASPIDIACEAE

33b. Fronds approximate; costae and costules raised or not.

34a. Indusial flaps opening towards margin . . . . . 28. LINDSAECEAE

34b. Indusia opening away from margin (inwards).

35a. Sporangia borne on the reflexed or straight marginal lobes.

36a. Marginal flaps restricted to submarginal region, reniform-orbicular . . . . . 18. ADIANTACEAE

36b. Marginal flaps meeting at the costae, linear, confluent . 16. CRYPTOGRAMMACEAE

35b. Sporangia continuous, protected by reflexed margin.

37a. Rachis grooved on upper surface, so as to admit the groove of midrib of pinnae . . . . 17. PTERIDACEAE

37b. Rachis not grooved.

38a. Fronds white powdery beneath . . . . . 15. SINOPTERIDACEAE

38b. Fronds not white powdery beneath . . . . . 27. HYPOLEPIDACEAE

28b. Sori dorsal, superficial on the veins; rarely marginal.

39a. Indusia double.

40a. Veins anastomosing (at least some veins in certain species).

41a. Fronds dimorphic; sori acrostichoid . . . . . 38. BLECHNACEAE

41b. Fronds monomorphic (rarely sub-dimorphic); sori linear.

42a. Sori paired, dorsal along veins; indusium attached back to back such that sori open on opposite ends . . . . . 31. ATHYRIACEAE

42b. Sori submarginal or marginal; indusium formed by reflexed margin of lamina, opening inside . .

43a. Inner indusium present; sporangia protected by reflexed margin . . . . 17. PTERIDACEAE

43b. Inner indusium absent; sporangia on the reflexed marginal lobes . . . . 18. ADIANTACEAE

40b. Veins free; forked.

44a. Costae, costules and rachis grooved, not swollen at the joints.

45a. Rhizome ascending . . . . . 17. PTERIDACEAE

45b. Rhizome erect. . . . . .38. BLECHNACEAE

44b. Costae and costules grooved, joints swollen.

46a. Scales clathrate, hairs on rhizome lacking . . . . . 38. BLECHNACEAE

46b. Scales not clathrate; rhizome with multicellular hairs . . . 31. ATHYRIACEAE

39b. Indusium single.

47a. Sori linear.

48a. Sori parallel to costae and costules . 38. BLECHNACEAE

48b. Sori parallel to oblique veinlets.

49a. Basal stipe scales clathrate; indusium linear . . . . . 30. ASPLENIACEAE

49b. Basal stipe scales opaque; indusium curved ('J'-shaped or reniform), always crossing a veinlet . . . 31. ATHYRIACEAE

47b. Sori round.

50a. Tree ferns with a trunk-like stem; stipe aculeate . . . . . 25. CYATHEACEAE

50b. Not distinctly tree ferns; stipe not aculeate.

51a. Sori symmetrically divided by lateral veins; scales glandular hairy; opposite pairs of lateral pairs of opposite pinnae lobes uniting with an excurrent veinlet above the sinus; fronds covered by unicellular hairs . . . . . 29. THELYPTERIDACEAE

51b. Otherwise.

52a. Indusium globose, stalked, solitary on each ultimate segment . .32. ASPIDIACEAE (Peranema)

52b. Indusium otherwise.

53a. Rachis grooved on the dorsal side; base of stipe with 2 vascular bundles; indusia 'J'shaped or reniform . . 31. ATHYRIACEAE

53b. Rachis grooved or not; base of stipe with several vascular bundles; indusia reniform or round and peltate . 32. ASPIDIACEAE

1. LYCOPODIACEAE

Epiphytes or terrestrials. Stems erect, prostrate or pendulous, creeping or scandent. Branches leafy, dichotomous. Leaves microphilous, simple, small, eligulate, 1-nerved, usually spirally arranged or decussate, rarely in two planes, sometimes decurrent. Sporophylls uniform, aggregated in terminal strobili or rarely the fertile and sterile zones alternating. Sporangia solitary at the axils of sporophylls or on the adaxial surface, uniform, unilocular, dehiscing into 2-valves; spores homosporous, tetrahedral.

A family of 7 genera; 1 in Nagaland.

Lycopodium

Linn., Sp. Pl. 1100. 1753.

Characters of the family.

A genus of about 200 species; 7 in Nagaland.

K E Y T O S P E C I E S

1a. Sporophylls forming distinct strobilus.

2a. Epiphytes; branches pendent.

3a. Leaves linear; strobilus unbranched; more than 4 mm in diam. . . . squarrosum

3b. Leaves triangular-ovate; strobilus dichotomously branched, 1 - 2 mm in diam. . . . . phlegmaria.

2b. Terrestrials; branches otherwise.

4a. Strobilus less than 1 cm long . . . cernuum.

4b. Strobilus 4 - 6 cm long . . . . clavatum

1b. Sporophylls scattered, not forming a strobilus.

5a. Leaves narrow linear, needle-like . . setaceum.

5b. Leaves 4 - 6 mm wide, not needle-like.

6a. Leaves serrate; sporangia with fimbriate surface at base; spores apically capped . . . . . serrata

6b. Leaves entire, sporangia with smooth basal surface; spores without apical caps . . . . . hamiltonii

Lycopodium cernuum Linn., Sp. Pl. 1103. 1853; Spring, Monogr. Lycopod. 79. 1841; Clarke in Trans. Linn. Soc. ser. 2(Bot.) 1: 591. 1880; Baker, Fern Allies 22. 1887; DeVol, Fl. Taiwan 1: 35. (ed 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 22. 1982.

(Plate 14 A)

Terrestrials. Main stem up to 0.2 - 0.4 cm across, rather stout, short-creeping, prostrate, much branched; roots tufted at definite intervals. Fertile branches erect, divaricate; leaves up to 0.4 cm long, very narrow, linear, acute, finely ciliate, margin entire, spirally arranged, slightly decurrent on the stem. Strobili up to 0.8 × 0.3 cm,

oblong, sessile, borne terminally at the end of short, fertile branches, solitary, pendent; sporophylls up to 0.2 x 0.1 cm, pale-yellowish, broadly ovate, narrowly-lanceolate with hair-tipped apices, margin ciliate; sporangia oval, whitish-yellow; spores pyramidal, hyaline, smooth.

Common in exposed grasslands on hilly slopes and along road cuttings on hills. Commonest of the Lycopodiums in Nagaland.

Fertile: July - December.

Distribution: In tropical and subtropical regions of the world; INDIA - Meghalaya at 35 - 100 m elevation.

Specimens examined: Jamir 6045 Peren (Kohima dist., 1446 m); 6379 Mezenkong (Mokokchung dist., 1326 m); 6439 Zenkeboto (Zenkeboto dist., 1875 m); 6610 Mon (Mon dist., 898 m); 6215 Changki (Mokokchung dist., 1000 m).

Lycopodium clavatum Linn., Sp. Pl. 1101. 1753; Spring, Monogr. Lycopod. 77. 1841; Clarke in Trans. Linn. Soc. ser. 2 (Bot.) 1: 592. 1880; DeVol, Fl. Taiwan 1: 35 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 22. 1982.

L. divaricatum Wall. ex Hook. et Grev. in Hook. Bot. Misc. 2: 377. 1831.

(Plate 14 B)

Terrestrials. Main stem prostrate, wide-creeping, rooting at intervals. Fertile branches numerous, short, erect, procum-

bent, dichotomous. Leaves up to 0.8 x 0.1 cm, linear-lanceolate, spirally arranged, usually ending in long hair-tipped or acute apices, margin entire, rigid. Strobili 2 - 6 on each fertile twig, about 3 - 7 x 0.3 - 0.5 cm, linear-oblong, erect or slightly curved; peduncle 0.5 - 2 cm long, erect, slender, bearing yellowish-green, linear-subulate, spirally arranged bracts. Sporophylls up to 0.5 x 0.5 cm, deltoid-aristate or broadly ovate with long, narrow, acuminate tips, margins scarious, erose, irregularly ciliate; sporangia reniform, pale-yellowish; spores oval, yellowish-brown.

Very common, in exposed areas usually along roadsides in hilly areas. One of the very variable species of this genus.

Fertile: July - December.

Distribution: Widely distributed in the temperate regions and alpine regions of the tropics; INDIA - Meghalaya at 30 - 1400 m elevation.

Specimens examined: 6159 Pfutseso (Phek dist., 2135 m); 6318 Morong forests, Sangpore (Tuensand dist. , 2134 m); 6435 Zenheboto (Zenheboto dist., 1875 m).

Lycopodium hamiltonii Spreng ex Hook. et Grev. in Hook. Bot. Misc. 2: 366. 1831; Spring, Monogr. Lycopod. Part. 2: 16. 1848; (not of part 1: 35. 1841); Clarke in Trans. Linn. Soc. ser. 2 (Bot.) 1: 590. 1880; Baishya & Rao, Ferns & Fern-allies Meghalaya 22. 1982. L. obtusifolium Ham. in Don, Prodr. Fl. Nepal. 18. 1825.

(Plate 15 A) ?

Epiphytes. Branches dichotomously forked, erect when young, but soon becoming pendent, about 10 - 20 cm long. Leaves dimorphous; upper branches with smaller leaves, the lower matured leaves more broader than that of upper ones; leaves arranged in two alternate planes and pointing outward or oblique to the rachis; larger leaves up to 1.5 x 0.5 cm, elliptic or oblong, shortly petiolate or sessile, alternate at base, broadest somewhat at middle, obtuse or round at apex, margin entire; texture thick, coriaceous, shining, green, glabrous on both surfaces. Strobili absent; sporophylls and upper younger leaves lanceolate; sporangia adaxial on the axil of leaves, reniform, pale-yellowish; spores pyramidal, with 3 apical markings, hyaline; exine papillate.

Rare; collected only once on moist shady and moss-covered tree-trunks in forests. Conservation measures are urgently needed for this species.

Fertile: May - September.

Distribution: CHINA, JAPAN, TAIWAN, INDIA - Meghalaya at 1600 - 1990 m elevation.

Specimens examined: Jamir 7204 Kohima (Kohima dist., 1445 m).

Lycopodium phlegmaria Linn., Sp. Pl. 1564. 1753; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 592 - 593. 1880; DeVol, Fl. Taiwan 1: 30. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 23. 1982.
(Plate 15 B).

Epiphytes. Branches pendulous, long, rigid, dichotomously branched, about 20 - 40 cm long. Rhizome very short with fibrous roots, covered with whitish-silky rhizoides. Leaves about 1 - 1.5 x 0.3 - 0.5 cm, triangular to ovate-lanceolate, thick, shortly petiolate, broadly enlarged at base, gradually tapering into an acute apex, margin entire; texture coriaceous, glabrous on both surfaces, greenish, shining, distant, spreading. Strobili about 5 x 0.2 cm, linear, borne at the terminal of branches, 2 - 3 times dichotomously forked, sessile, moniliform, yellowish-green when dry; sporophylls about 0.2 cm long, ovate-lanceolate, compact, base clasping, slightly acute at apex, margin entire, pale-green; sporangia about 1 cm across, reniform, whitish.

Rare; on humus deposits and moss-covered tree trunks in dense forests. The habitat of this species is also greatly shrinking due to removal of forests.

Fertile: February - May.

Distribution: In old world tropics, TAIWAN, JAPAN, INDIA-Meghalaya, up to 900 m elevation.

Specimens examined: Jamir 7202 Changki (Mokokchung dist., ±1000 m).

Lycopodium serratum Thunb., Fl. Jap. 341, t. 38, 1784; D. Don, Prodr. Fl. Nepal 19. 1825; Spring, Monogr. Lycopod. 39. 1841; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 591. 1880.

L. javanicum Sw., Syn. Fil. 175: 399. 1806.

L. sulcinervium Spring, Monogr. Lycopod. 39. 1841. (Plate 15 C).

Terrestrials. Branches creeping, subterranean, ascending giving rise to erect branches. Stems about 10 - 25 cm long, dichotomously branched, rigid. Leaves 1 - 2 x 0.3 - 0.7 cm, elliptic to oblanceolate, spathulate, spirally arranged, subsessile or shortly petiolate (up to 0.3 cm long), gradually attenuate at base, broadest somewhat at middle, obtuse or shortly acuminate at apex, margin sharply serrate; texture sub-coriaceous, pale-greenish, glabrous on both surfaces; veins obscure. Strobili absent. Sporophylls similar to vegetative leaves; sporangia abundant, reniform, pale-brown, adaxial on the axils of leaves; spores distinctly 'T'-shaped, in tetrads, hyaline, exine pitted.

Frequent, on moist shady or open forest floor.

Fertile: July - November.

Distribution: INDIA - Meghalaya at 700 - 1990 m elevation

Specimens examined: Jamir 7218 Kohima (Kohima dist., 1445 m).

Lycopodium setaceum Buch.-Ham., ex D. Don, Prodr. Fl.Nepal 18. 1825; Spring, Monogr. Lycopod. 42. 1841; Clarke in Trans. Linn. Soc. ser. 2 (Bot.) 1590. 1880.

L. pulcherrimum Wall. ex Hook., et Grev. in Hook. Bot. Misc. 2: 367. 1831; DeVol, Fl. Taiwan 1: 33 (ed. 2). 1980.

L. gramineum Spring, Monogr. Lycopod. Part. 2, 19.1841.

Epiphytes. Stem lax, sometimes pendulous or elongate, dichotomously branched, about 10 - 25 cm long; rhizome very short, roots fibrous. Leaves up to 0.5 - 1.2 x 0.1 - 0.2 cm, linear, sessile, acute, margin entire, spirally arranged, crowded; texture subcoriaceous, glabrous on both surfaces, greenish; sporangia on the axils of leaves, reniform, yellowish-white, margin fimbriate at base. Strobili absent, sporophylls usually borne on the upper half of branches, similar in shape and size with that of vegetative leaves; spores oval, with an apical cap-like structure, brown with 2 - 3 vacuoles; exine papillate.

Frequent, on moist shady or exposed tree trunks in forests.

Fertile: October - November.

Distribution: NEPAL, TAIWAN, INDIA - Meghalaya.

Specimens examined: Jamir 7219 Changki (Mokokchung dist., 1000 m); 7201 Kohima (Kohima dist., 1445 m).

Lycopodium squarrosum Forst., Prodr. Fl. Austral. 86. 1786; Hook. et Grev. in Hook. Bot. Misc. 32: 369. 1831; Spring, Monogr. Lycopod. 52. 1841; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 591. 1880; DeVol, Fl. Taiwan 1: 34 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 23. 1982.

(Plate 15 D).

Epiphytes. Stem pendulous, about 20 - 60 x 0.5 - 1 cm (stems including leaves about 1.5 - 2.5 cm across); branches usually forked once or twice; leaves up to 1.7 x 0.2 cm, numerous, narrowly linear-lanceolate, spirally arranged, sharply acuminate or acute at apex, margin entire, rigid; texture coriaceous, yellowish-green when dry; basal leaves much reflexed. Strobili about 3 - 8 x 0.5 - 0.8 cm, linear-oblong, sessile, terminal, 1 - 3 together, terminally on each fertile twig. Sporophylls up to 0.8 x 0.2 cm, linear, ovate-lanceolate, sharply acute, margin entire, rigid, coriaceous, yellowish-green when dry; sporangia reniform, whitish; spores small, triangular, hyaline.

Frequent, grows on rather exposed tree trunks in secondary forests.

Fertile: May - August.

Distribution: TAIWAN, TROPICAL POLYNESIA, AFRICA, INDIA-Meghalaya.

Specimens examined: Jamir 6058 Peren (Kohima dist. 1446 m); 7116 Changki (Mokokchung dist., 1000 m).

2. SELAGINELLACEAE

Annuals or perennial terrestrial herbs. Stems slender, tufted, erect or creeping, often climbing, rooting at intervals, bearing rhizophores. Branches alternate or dichotomous, usually all in one plane. Leaves numerous, small, simple, with a single vein, ligulate on the adaxial side at its base, ligule prominent only on young leaves. Vegetative leaves similar or dimorphic, usually arranged in two median and two lateral rows on the branches; the median leaves usually smaller, ascending, adpressed to the stem, lateral leaves larger;the single axillary leaf (clearly distinct from the lower side) borne at the forking of each branch, being somewhat different from the other leaves. Strobili terminal or stems bearing ligulate sporophylls, tetrastichous or quadrangular, containing both megasporophylls and microsporophylls; microsporophylls with a single microsporangium containing a large number of microspores; megasporophylls with

four or less megaspores; sporangia round or oval, arising between ligule and the base of the sporophylls, dehiscing by a vertical slit; spores heterosporous, in tetrads; megaspores and microspores borne in separate sporangia.

A family of single genus, Selaginella P. Beauv.

Selaginella

P. Beauv. Prodr. 101. 1805 nom. cons.; Baker, Fern.Allies 31. 1884.

Characters of the family.

About 700 species; 15 in Nagaland.

K E Y T O S P E C I E S

1a. Leaves dimorphic throughout.

2a. Branches dichotomous.

3a. Plants 20 - 40 cm long; rhizophores long and conspicuous . . . . . bisulcata

3b. Plants less than 15 cm long; rhizophores slender, hair-like . . . . . repanda

2b. Branches pinnate to decompound.

4a. Branches away from base.

5a. Lateral branches bipinnate.

6a. Strobilus 4 - 6 cm long . . . . . hookeri

6b. Strobilus 1 - 1.5 cm long . . . . wallichii

5b. Lateral branches decompound.

7a. Branches trailing.

8a. Main stem distinctly angled; leaves on the main stem quite apart . . willdenovii

8b. Main stem not angled; leaves on the main stem approximate and more or less overlapping . . . . . helferi

7b. Branches scandent . . . . . decipiens

4b. Branches from base only.

9a. Stem trailing; rhizophores throughout the stem . . . . . monospora

9b. Stem trailing or not; rhizophores confined to basal region.

10a. Stem stoloniferous . . . . . chrysocaulos

10b. Not stoloniferous.

11a. Leaves ciliate . . . . . ciliaris

11b. Leaves glabrous . . . . . tenuifolia

1b. Leaves monomorphic.

12a. Branches dichotomous; rhizophores confined to base of forkings . . . . . semicordata

12b. Branches otherwise; rhizophores absent or present.

13a. Branches away from the base; inrolled when dry; leaves compact . . . . involvens

13b. Branches from base, not inrolled when dry.

14a. Apex of stem stoloniferous; leaves glabrous or so. . . . . pentagona

14b. Apex of stem not stoloniferous; leaves minute, hairy . . . . subdiaphana

Selaginella bisulcata Spring in Mem. Acad. Sci. Brux. 24: 259. 1850; Alston in Proc. nat. Inst. India 11: 225. 1945; Panigrahi & Dixit in Proc. nat. Acad. Sci. India 36: 102. 1966; Baishya & Rao, Ferns & Fern-allies Meghalaya 25. 1982.

Terrestrials. Stems up to 40 cm long, procumbent to suberect, straggling, soft, brittle, shining, straw-coloured to pale-green when dry, dichotomously branched; rhizophores slender, long, arising from the joints of branches. Leaves dimorphic trhoughout, yellowish-green when dry, midrib distinct; lateral leaves up to 0.4 cm long, slightly oblique, oblong-acuminate, acute, margin sparsely dentate at proximal side; median leaves obovate, mucronate or acuminate-aristate, margin dentate. Leaves of median stem up to 0.5 x 0.3 cm, broadly ovate to cordate oblong, acuminate. Strobili up to 0.8 cm long; sporophylls dimorphic; smaller ones fertile, borne at the same plane as the lateral leaves, ovate-lanceolate, acute or obtuse, margin denticulate; microspores round, trilete; exine with wart-like protruberances.

Fairly common on hill slopes, specially on humus covered soils.

Fertile: July - December.

Distribution: INDIA- Assam, Meghalaya, West Bengal, Arunachal Pradesh and Utter Pradesh.

Specimens examined: Jamir 6107 Kohima (Kohima dist., 1445 m) 6448 Zenkeboto (Zenkeboto dist., 1870 m).

Selaginella chrysocaulos (Hook. et Grev.) Spring in Bull. Acad. Sci. Brux. 10: 232. 1843; Alston in Proc. nat. Inst. Sci. India 11: 225. 1945; Panigrahi & Dixit, in Proc. nat. Inst. Sci. India 36: 103. 1966; Baishya & Rao, Ferns & Fern-allies Meghalaya 26. 1982. Lycopodium chrysocaulos Hook. et Grev. in HOok. Bot. Misc. 2: 40. 1831.

Terrestrials. Stems up to 25 cm long, slender, erect, decumbent, pinnately branched from base; rhizophores stoloniferous, borne at base only; longerst lateral branche up to 10 cm long, usually the lowest ones largest, often shortened to above. Leaves dimorphic, thin, subcoriaceous; lateral leaves about 0.2 x 0.1 cm, ovate, unequal sided, dentate except at very base, acute, median leaves arranged in two alternate rows, ovate-lanceolate, acuminate, margin dentate, leaves of the main stem about 0.3 x 0.2 cm, broadly ovate to cordate, acuminate. Strobili up to 0.5 cm long; sporophylls dimorphic, smaller sporophylls fertile, ovate-elliptic, acuminate, margin dentate, larger sporophylls sterile, oblanceolate, acuminate, margin dentate, membranous; sporangia globose, greenish; spores round, dark-brown; exine papillate.

Frequent on moist slopes of hills and on exposed forest floor.

Fertile: October.

Distribution: CHINA; INDIA- North-India in mountain regions, Meghalaya.

Specimens examined: Jamir 6608 Mon (Mon dist. 898 m),

Selaginella ciliaris (Retz.) Spring in Bull. Acad. Sci. Brux. 10: 231. 1843; Panigrahi & Dixit in Proc. Sci. India 43B(4): 194-195. 1968; DeVol, Fl. Taiwan 1: 49 (ed. 2).Pl. 10. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 26. 1982.

Lycopodium ciliare Retz., Obs. 5: 321. 1789.

Terrestrials. Stems 3 - 7 cm long, erect-procumbent, copiously branched from base; rhizophores arising at intervals but mostly near the base. Leaves dimorphic; lateral leaves about 0.2 cm or more long, obovate, unequal sided, acute, margin dentate, midrib prominent, aristate, ciliate, pointing upwards. Strobili about 0.3 - 1 cm long, terminal; sporophylls dimorphic, smaller ones fertile, ciliate, ovate-acuminate, aristate, acute; larger ones sterile, oblanceolate, margin dentate, obtuse at apex, megasporangia and microsporangia in the same strobilus; megaspores trilete, round, exine with verrucoid protruberances; microspores trilete, round, brick-red, exine with wart-like protruberances.

Rare; on moist and humus covered rocks, rather in partially exposed places.

Fertile: October - November.

Distribution: CHINA, TAIWAN, THE PHILIPPINES, AUSTRALIA, SRI LANKA, BURMA, INDIA- South India; Maharashtra, Bihar, Orissa, West Bengal, Assam, Meghalaya, Andaman & Nicobar Islands.

Specimens examined: Jamir 6572 Chumukitema (Kohima dist., 250 m).

Selaginella decipiens Warb., in Monsunia 1: 127. 1900;

Alston in Proc. nat. Inst. Sci. India 11: 228. 1945;

Panigrahi & Dixit in J. Ind. Bot. Soc. 46: 225. 1967;

Baishya & Rao, Ferns & Fern-allies Meghalaya 26. 1982.

Terrestrials. Stems up to 75 cm or more long, usually erect, often decumbent, pinnately branched only on the upper part; rhizophores wide-creeping, usually arising from the base only; lateral branches alternate on the main stem, largest up to 18 cm long, leaves dimorphic, dark-green, thin-membranous; lateral leaves deltoid, to obovate, oblique, alternate, margin entire; median leaves lanceolate, arranged in two alternate rows, aristate, margin entire; leaves on the main stem up to 0.4 x 0.2 cm, cordate to ovate-acuminate, distant, spirally arranged. Strobili up to 1 cm long; sporophylls

deltoid-acuminate, acute, margin entire, sporangia yellow green; spores minute, triangular to oval, pale-green.

Abundant, in moist and shady places near streams and river banks.

Fertile: February.

Distribution: INDIA - Meghalaya (at 990 m).

Specimens examined: Jamir 7972, 7973, 7974 Changki (Mokokchung dist., 1000 m).

Selaginella helferi Warb. in Monsunia 1: 121. 1900; Panigrahi & Dixit in J. Ind. Bot. Soc. 46: 226-227. 1967; Baishya & Rao, Ferns & Fern-allies Meghalaya 26. 1982.

Terrestrials. Stem up to 50 cm or more long, trailing, irregularly and pinnately branched, rhizophores at base only largest lateral branch up to 20 cm long. Leaves dimorphic throughout, thin, subcoriaceous, entire; lateral leaves about 0.3 x 0.1 cm, oblong, slightly oblique, acute, spreading; median leaves oblanceolate, unequal-sided, acuminate. Strobili about 0.3 - 1 cm or more long; sporophylls uniform, ovate-lanceolate, margin entire; both megasporangia and microsporangia in the same strobilus; megaspores trilete, round, exine spinulose; microspores trilete, subglobose, exine reticulate.

Frequent; grows in moist, shady places among bushes in orest margins.

Fertile: July - October.

Distribution: INDIA - Meghalaya at 300 - 1000 m elevation.

Specimens examined: Jamir 6106 Kohima (Kohima dist., 1445 m) 369 Morong forests, Sangpor (Tuensang dist., 2134 m).

Selaginella hookeri Baker in J. Bot. 23: 21, no. 206, 1885;
Panigrahi & Dixit, in J. Ind. Bot. Soc. 46: 227. 1967;
Baishya & Rao, Ferns & Fern-allies Meghalaya 27. 1982.

Perennial herbs. Stems up to 70 cm or more long, decumbent, nnately branched; rhizophores wide-spreading, usually arising om the base only; lateral branches alternate, bipinnate, up 25 cm long with a 6 - 8 cm long, caudate apex; lowest ones ually shorter. Leaves dimorphic; lateral leaves obovate-nceolate, obtuse, margin entire, median leaves ovate, somewhat ricled at base, shortly acuminate, acute, margin denticulate; illary leaves overlapping. Strobili about 2 cm or more long, th megasporangia and microsporangia in the same strobilus; gaspores trilete, oval, exine spinulose; microspores trilete, und, exine verrucoid.

Very common in shady places near streams and river banks, d also along road cuttings on hills; frequent among bushes d thickets.

Fertile: July - October.

Distribution: INDIA - Meghalaya (at 300 - 1400 m elevation)

Specimens examined: Jamir 6604 Mon (Mon dist., 898 m); 7424, 7032 Changki, Longnak (Mokokchung dist., 250 m).

Selaginella involvens (Sw.) Spring in Bull. Acad. Sci. Brux. 10: 136. 1843; Alston in Proc. nat. Inst. Sci. India 11: 220. 1945; Panigrahi & Dixit in J. Ind. Bot. Soc. 46: 229. 1967; DeVol, Fl. Taiwan 1: 45 (ed.2). 1981; Baishya & Rao, Ferns & Fern-allies Meghalaya 27. 1982.

Lycopodium involvens Sw., Syn. Fil. 182. 1806.

Terrestrials, 15 - 40 cm long, main stems terete, erect, branching from above the middle; rhizome widely-creeping, shallowly subterranean; rhizophores wide-spreading, arising from the base. Leaves on the lower part of stem up to 0.3 x 0.2 cm long, broadly ovate-acuminate, auricled, midrib distinct, margins erose and long ciliate at apex; lateral branches up to 4 - 10 cm long, usually the lowest ones somewhat largest; leaves dimorphic, compact, spirally arranged, inrolled when dry; lateral leaves oblique, broadly ovate-lanceolate, to cordate-acuminate, ciliate near base, pointing outwards; midrib distinct; median leaves arranged in two rows, compact alternate, elliptic to lanceolate, acuminate; axillary leaves unequal sided, ovate, acute, minutely ciliate. Strobili up to 0.5 cm long, tetragonal, sporophylls monomorphic, ovate, acuminate, aristate, minutely ciliate; spores oval, trilete.

Frequent, on moist humus collected rocks near streams; occasionally grows on moss-covered tree-trunks. During dry season the leaves and branches get involutely rolled up.

Fertile: July - October.

Distribution: KOREA, JAPAN, TAIWAN, CHINA, VIETNAM, INDIA - Meghalaya.

Specimens examined: Jamir 6149 Pfutsero (Phek dist., 2134 m); 6370 Morong forests (Tuensang dist., 2134 m).

Selaginella monospora Spring, in Mem. Acad. Sci. Brux. 24: 135. 1850; Alston in Proc. nat. Inst. Sci. India 11: 228. 1945; Panigrahi & Dixit in Proc. nat. Inst. Sci. India 34: 201. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 27. 1982.

S. semicordata sensu Burkill in Rec. bot. Surv. India 10: 228. 1925.

Terrestrials. Stems up to 30 cm long, straggling, decumbent or semierect, branched from base, up to 10 cm long; decompound; rhizophores at the dichotomous forkings of the stem. Leaves dimorphic, distant on the main stem, greenish, coriaceous, midrib prominent; lateral leaves deltoid to ovate, slightly oblique, obtuse, ciliate above; median leaves ovate acuminate, margin finely dentate, close, arranged in two alternate rows. Strobili about 0.5 - 1 cm long; sporophylls dimorphic, smaller sporophylls fertile, ovate-acuminate, margin dentate;

larger ones sterile, oblanceolate, margin denticulate, obtuse; megasporangia and microsporangia in the same strobilus; megaspores oval, exine with verrucoid protruberances; microspores trilete, ovate, rather triangular.

Abundant along streams and river banks and in similar situations.

Fertile: February.

Distribution: NEPAL, BHUTAN, BURMA, CHINA, INDIA- Eastern India: Arunachal Pradesh and Meghalaya.

Specimens examined: Jamir 7082 Changki (Mokokchung dist., 250 m).

Selaginella pentagona Spring, Mem. Acad. Brux. 24: 150. no. 92. 1850; Panigrahi & Dixit in Proc. nat. Acad. Sci. India 34: 104. 1966; Baishya & Rao, Ferns & Fern-allies Meghalaya 28A. 1982.

Terrestrials. Stems up to 90 cm or more long, decumbent, or semi-erect; rhizophores wiry, pale-brown with spreading roots. Leaves uniform at the base of main stem, sparse, distant; leafy braches dimorphic; largest up to 18 cm long, the lowest ones usually shorter than the above; lateral leaves up to 0.3 cm long, ovate-lanceolate, obtuse, margin finely denticulate; axillary leaves ovate, acuminate, margin dentate. Strobili about 0.3 - 1 cm long, terminal on main branches and also on side branches; sporophylls uniform, ovate-acuminate,

acute, margin dentate; megasporangia and microsporangia in the same strobilus; megaspores trilete, round, exine with verrucoid protruberances; microspores trilete, ovate or round.

Common in moist and shady places under bushes on hill slopes.

Fertile: December.

Distribution: INDIA- E. Himalayas; Assam, Meghalaya.

Specimens examined: Jamir 7925 Kohima (Kohima dist., 1445 m).

Selaginella repanda (Desv. ex Poir.) Spring in Gaud. Voy. Bonite Bot. 1: 329. 1846; Panigrahi & Dixit in J. Ind. Bot. Soc. 46: 231. 1967; DeVol, Fl. Taiwan 1: 46(ed.2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 28. 1982.

Lycopodium repanda Desv. ex Poir in Lamarck Encycl. Suppl. 3, 558. 1814.

Terrestrials. Stems 5 - 20 cm long, procumbent or decumbent, rather delicate; dichotomously branched; rhizophores usually on the main stem throughout; largest leafy branches up to 8 cm or more long, the lowest ones shorter than the above. Leaves dimorphic, greenish-brown, thin, membranous, spirally arranged; lateral leaves ovate, acute, ciliate, unequal sided; median leaves ovate-lanceolate, acuminate, margin dentate,

aristate. Strobili about 0.5 - 1.5 cm long, terminal on branches; sporophylls uniform, cordate-lanceolate, acuminate, membranous, keeled; megaspores whitish; microspores orange-brown, triangular, exine papillate.

Abundant on humus covered rocks near streams and river banks, and also on roadsides on hills.

Fertile: October - November.

Distribution: JAVA, THE PHILIPPINES, CHINA, TAIWAN, INDIA - Meghalaya at 1300 m elevation.

Specimens examined: Jamir 6569 Chumuketema (Kohima dist., 250 m).

Selaginella semicordata (Wall. ex Hook.et Grev.) Spring in Mart. Fl. Bras. 1(2): 122. 1840; Alston in Proc. nat. Inst. Sci. India 11: 122. 1945; Baishya & Rao, Ferns & Fern-allies Meghalaya 28. 1982.

Lycopodium semicordatum Wall. ex Hook. et Grev. in Hook. Misc. Bot. 2: 396. 1831.

Terrestrials. Stems up to 60 cm or more long, slender, wide-creeping, procumbernt, repeatedly, dichotomously branched; rhizophores long, spreading, borne at the forkings of branches, pale-green; leaves spirally arranged in two plane, oblique, oblanceolate, margin entire, membranous. Strobili up to 0.8 cm long; sporophylls ovate-lanceolate, acuminate, ciliate at base, dentate at the apex; sporangia oval, orange-coloured;

spores oval to triangular, dark-brown; exine papillate to spinulose.

Abundant as undergrowth of bushes in moist and shady places on hills.

Fertile: July - October.

Distribution: INDIA - Meghalaya at 1000 - 1300 m elevation.

Specimens examined: Jamir 6044 Peren (Kohima dist., 10000 m); 6108 Kohima (Kohima distt, 1445 m); 6372 Morong forests ((Tuensang dist., 2134 m); 6611 Mon (Mon dist., 898 m).

Selaginella subdiaphana (Wall. ex Hook. et Grev.) Spring in Bull. Acad. Sci. Brux. 10: 232. 1843; Alston in Proc. nat. Inst. Sci. India 11: 230. 1945; Baishya & Rao, Ferns & Fern-allies Meghalaya 28. 1982.
Lycopodium subdiaphana Wall. ex Hook. et Grev. in Hook. Misc. Bot. 2: 401. 1831.
Selaginella glauca Spring in Mem. Acad. Sci. Brux. 24: 252. 1850.

Terrestrials. Stems up to 30 cm long, slender, erect, pinnately branched, not stoloniferous; rooting at base only, rhizophores absent; largest branch up to 8 cm long. Leaves dimorphic, membranous, herbaceous; lateral leaves spirally arranged, about 0.2 x 0.1 cm, ovate-lanceolate, acuminate, dorsal leaves also spirally arranged in two rows, ovate-lanceolate, margin ciliate towards the tip; leaves of the main

stem about 0.3 x 0.2 cm, broadly ovate, acuminate. Strobili up to 0.5 cm long, usually borne on almost all the terminal branches; sporophylls lanceolate-acuminate, margin dentate, thin, coriaceous; sporangia large, orange coloured at maturity; spores large, oval, dark-red; exine tuberculate.

Fairly common on hill slopes and on moist shady forest floor.

Fertile: May - June.

Distribution: INDIA- Meghalaya at 1300 m elevation.

Specimens examined: Jamir 7209 Changki (Mokokchung dist., 1000 m).

Selaginella tenuifolia Spring in Bull. Acad. Sci. Brux. 24: 253. 1850; Panigrahi & Dixit in Proc. nat. Sci. India (Sec. B) 36: 104. 1966; Baishya & Rao, Ferns & Fern-allies Meghalaya 28. 1982.

S. chrysorrhizos Spring in Mem. Acad. Sci. Brux 24: 251. 1850.

Terrestrials. Stems up to 12 cm long, erect, procumbent, irregularly branched from base; roots usually near the base. Leaves dimorphic throughout; lateral leaves about 0.2 cm long, ovate, obtuse, margin dentate; median leaves ovate-acuminate, acute, ; bracts small, elongate, acuminate, margin finely toothed; Strobili up to 0.8 cm long; sporophylls dimorphic, ciliate; larger sporophylls sterile, oblong, acute;

smaller sporophylls fertile, ovate, acuminate; microspores trilete, round or oval.

Rare; on moist, rather shady forest floor.

Fertile: October.

Distribution: BURMA, INDIA - Sikkim, Arunachal Pradesh and Meghalaya.

Specimens examined: Jamir 6570 Chumuketema (Kohima dist., 250 m).

Selaginella wallichii (Hook. et Grev.) Spring, in Mart. Fl. Bras. 1(2): 124. 1840; Panigrahi & Dixit in Proc. nat. Acad. Sci. India 34B: 204-205. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 29. 1982.
Lycopodium wallichii Hook. et Grev. in Hook. Bot. Misc. 2(106): 384. 1831.

Perennial herbs. Stems about 90 cm or more long, erect or suberect, smooth, straw-coloured when dry, pinnately branched at intervals, lateral branches bipinnate, tips of branches long, slender; Leaves dimorphic throughout; lateral leaves about 0.4 cm long, rather obliquely ovate, acute, margin usually entire; median leaves ovate, acuminate, margin entire, bi-auriculate, oblique at base; leaves of the main stem deltoid to cordate, acuminate, distant, spiral, not enlarged. Sporophylls uniform, ovate, acuminate, margin entire; both megasporangia and microsporangia in the same strobilus;

microspores trilete, oval; megaspores oval, exine with verrucoid protruberances.

Frequent, on moist shady places near streams and river banks in forests.

Fertile: May - June.

Distribution: BURMA, MALAYA, SUMATRA, COMBODIA, LAOS, TOUKIN, INDIA - Arunachal Pradesh, Meghalaya (at 150 - 1400 m).

Specimens examined: Jamir 7108 Changki (Mokokchung dist., 1000 m).

Selaginella willdenovii (Desv.) Baker in Gard. Chron. 789 & 950 . 1867; Alston in Proc. nat. Inst. Sci. India 11: 224. 1945; Panigrahi & Dixit in Proc. nat. Inst. Sci. 34B: 207. 1968.

Lycopodium willdenovii Desv. in Poir. in Lamk. Encyl. 3, 540, 552, No. 87. 1814.

Perennial herbs. Stems about 1 m or more long, trailing, scandent, wide-creeping, pinnately branched; stems and branches glabrous, shining, sulcate or irregularly grooved, brownish or straw-coloured when dry. Leaves dimorphic throughout; lateral leaves about 0.3 cm long, ovate-lanceolate, abruptly ending, margin entire; leaves of the main stem up to 0.4 x 0.2 cm, broadly deltoid to cordate, acuminate,

distant, spirally arranged. Strobili up to 0.6 cm long; sporophylls broadly ovate-acuminate, acute, margin entire; both megasporangia and microsporangia in the same strobilus; microspores round, trilete, exine bluntly spinulose.

Not common; wide spreading among grasses in exposed areas; sometimes climbing on small trees and bushes.

Fertile: October - November.

Distribution: BURMA, CHINA, MALAYA, SUMATRA, JAVA, BRAZ BRAZIL, TOUKIN, ANNAM; INDIA- Nicobar Islands, Arunachal Pradesh.

Specimens examined: Jamir 6687 Tijit (Mon dist., 100 m).

3. EQUISETACEAE

Terrestrials, perennials with long-creeping rhizomes; rhizomes with nodes and internodes; stems erect, green, radially symmeyrical, jointed, having nodes and internodes, with one to many branches at the nodes, striate, grooved; hollow troughout except at nodes; both sterile and fertile branches similar, green; cross section of internodes usually with large central cavity (the centrum) and a smaller cavity (the vascular canal); vascular bundles near the carinal canals, the endodermis rings either continuous or separate around silica; stomata sunken in the grooves; nodes with sheaths bearing either persistent or deciduous teeth-like scaly leaves. Strobili terminal, either on main stem or on ends of branches; sporangia on the back of stalked, sporangiophores; simple chambered; spores numerous, homosporous, round, green, with 4-elaters, gametophyte green, lobed.

A family of only genus, Equisetum Linn.

Equisetum

(Tourn.) Linn., Sp. Pl. 1061. 1753.

Characters of the family.

A genus of 23 species; 2 in Nagaland.

K E Y T O S P E C I E S

Branches diffuse, short, branchlets 5 - 6 at each node . . . . . diffusum

Branches lax, long and slender; branchlets 3 at each node . . . . . ramosissimum subsp. debile

Equisetum diffusum D. Don, Prodr. Fl. Nepal 19.1825; Clarke in Trans. Linn. Soc. ser. 2(Bot.) 1: 594. 1880; Baishya & Rao, Ferns & Fern-allies Meghalaya 29. 1982.

Terrestrials, herbaceous. Stems firm, erect, evergreen, up to 30 x 0.5 cm; fertile and sterile branches alike, firm, short, diffused with 5 - 6 branches at each node (whorled). Internodes 1 - 4 cm long; ribs 6 - 8; sheaths 0.2 - 1 cm long, loose, linear, entire, acute. Strobili 1 - 2 cm long, apiculate, stalked; spores reddish-brown, globose, elaters slener, reddish-brown.

Very common, on banks of rivers and moist sandy places in plains.

Fertile: February - December.

Distribution: INDIA - Meghalaya.

Specimens examined: Jamir 7198, 7183 Changki (Mokokchung dist., 1000 m); 6057 Peren, 7083 Kohima (Kohima dist., 1445 m) 6451 Zenkeboto (Zenkeboto dist., 1875 m); 6362 Shamator (Tuensang dist., 1692 m).

Equisetum ramosissimum Desf., Subsp. debile (Roxb.) Hauke in Amer. Fern J. 52: 33. 1962; DeVol, in Fl. Taiwan 2: 56 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 29. 1982.

Terrestrial perennials. Stem erect, evergreen, up to 150 x 1.5 cm; fertile and sterile branches similar, lax, simple or irregularly branched, long, slender, with 1 - 3 branches at each node, whorled; internodes 2 - 4 cm long; ribs 8 - 20, less prominent; sheaths 0.5 - 1.5 cm long, tight, with lanceolate-acuminate, dark brown margin, deciduous teeth. Strobili 0.5 - 2 cm long, apiculate, terminal, oblong, short-stalked or sessile; sporangiophores orbicular or oblong; sporangia oblong, yellowish; spores homosporous, round, elaters slender brownish.

Common on river banks, either in open or shady places; and also abundant in moist sandy areas.

Fertile: February - October.

Distribution: SRI LANKA, PHILIPPINES, INDONESIA, NEW CALEDONIA, TAIWAN, INDIA - Meghalaya.

Specimens examined: Jamir 7182 Teza river (Phek dist., 1000 m); 7991 Changki (Mokokchung dist., 1000 m).

4. BOTRYCHIACEAE

Terrestrials; succulent herbs. Rhizome short, fleshy with many, thick, fleshy roots. Stipes covered with brownish sheaths. Fronds dimorphic with fertile and sterile segments; sterile segments fleshy, pinnate or tripartite; veins forked, free; fertile segments paniculate. Sporangia globose, short stalked, brownish; spores hyaline, tetrahedral.

2 genera; 1 in Nagaland.

Botrychium

Swartz, Schrad. J. Bot. 1800. 2: 8, 110. 1801; C. Chr., Ind. Fil. 161. 1906; Copel. Gen. Fil. 12. 1947.

Terrestrials, fleshy, succulent herbs. Rhizome short with thick, fleshy roots. Stipes covered with sheaths. Fronds with a common stalk, dividing into a sterile and fertile segment; sterile segment pinnate or tripartite; veins free, forked; fertile segment paniculate. Sporangia shortly stalked, globose; spores tetrahedral.

Botrychium lanuginosum Wall., ex Hook. et Grev., var. lanuginosum Wall. ex Hook. et Grev., Ic. Fil. 1. t. 79. 1831; DeVol in Fl. Taiwan 1: 65. (ed. 2). 1980; Dhir. Ferns N.W. Himalayas 24. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 31. 1982.

(Plate 18).

Annual herbs. Rhizome short, fleshy, erect; roots fleshy, fibrous. Stipes 5 - 20 cm long, greenish, fleshy, base enlarged. Fronds dimorphic; sterile portion 10 - 28 x 12 - 30 cm, pinnate or tripartite, decompound, green, turning yellowish at maturity; ultimate divisions small, acute or obtuse; veins free, dichotomous; fertile portion 4 - 8 cm long, stalked, arising from the main rachis of sterile blade, paniculate, 3.5 - 18.5 cm long. Sporangia globose, short stalked, brownish; spores tetrahedral, hyaline; exine grooved.

Rare; in moist shady places in forests; associated with other ferns.

Fertile: June - November.

Distribution: INDONESIA, PHILIPPINES, CHINA, SRI LANKA, TAIWAN, INDIA - Meghalaya.

Specimens examined : Jamir 7208 Kohima (Kohima dist., 1445 m); 6313 Shamator (Tuensang dist., 1372 m).

5. OPHIOGLOSSACEAE

Small, terrestrial ferns. Rhizome usually short, erect, bearing few fronds simultaneously; roots slender, thick, often proliferating from erect, fleshy or tuberous rhizome. Fronds simple, linear to cordate-acuminate or oblanceolate, entire; differentiated into sterile and fertile segments; sterile segment simple, laminar; venation reticulate; fertile segment a simple spike, springing from sterile ones, compact; with two close rows of immersed sporangia, each opening by a transverse slit.

Only genus of the family - Ophioglossum

Ophioglossum

Linn., Sp. Pl. 1062. 1753; Copel. Gen. Fil. 11. 1947.

Characters of the family.

A genus of about 90 species, 1 in Nagaland.

Ophioglossum petiolatum Hook., Exotic Flora, 1: 56. 1823; Mehra & Bir, Res. Bull. Panjab. Univ. (N.S.), 15: 103. 1964; DeVol, Fl. Taiwan 1: 70 (ed. 2). 1980; Dhir Ferns N.W. Himalayas 26. 1980; Nair & Dixit in J. Bomb. Nat. Hist. Soc. 78: 458. 1981.

Ophioglossum pedunculatum Nakai. in Bot. Mag. Tokyo

39: 193. 1925.

(Plate 19).

Rhizome 1 - 1.5 cm long, short, erect, usually with 2 - 3 fronds. Stipes 3 - 8 cm long; sterile blade 3 - 6 x 0.5 - 1.5 cm, sessile or shortly petiolate, slightly cuneate or gradually tapering towards base, venation reticulate, midrib not distinct, often with included veinlets. Fertile portion stalked, about 2 - 7 cm long; spike 2 - 5.5 x 0.2 - 0.4 cm; sporangia embedded in 2 rows on either side of the spike. Spores finely reticulate.

Frequent, grows in moist, exposed grassy areas during rainy seasons; often goes unnoticed by botanists.

Fertile: May - June.

Distribution: Tropics and temperate regions of the world. INDIA - Utter Pradesh and Madhya Pradesh.

Specimens examined: Jamir 7157 Kohima Science College Campus, Kohima.(Kohima dist., 1500 m).

6. ANGIOPTERIDACEAE

Terrestrials; robust, herbaceous perennials. Rhizome short, erect, broad, massive, fleshy, with complex vascular system. Stipe fleshy, swollen at the base, Fronds bipinnate; pinnae swollen at the base; pinnules attached by short, swollen stalks, oblong or lanceolate; veins simple or forked, free. Sori dorsal, linear-oblong or boat-shaped, arranged in two close rows, attached on a vein near margin of the pinnules; sporangia dehiscing along slits on the ventral surface; spores small, hyaline, tetrahedral.

3 genera; 1 in Nagaland.

Angiopteris

Hoffmann, Comm. Soc. Reg. Sc. Gott. 12: 28. 1796 (nom. cons.); C. Chr., Ind. Fil. 56. 1906; Copel., Gen. Fil. 14. 1947.

Terrestrials; herbaceous perennials. Rhizome short, erect, massive, fleshy. Stipe fleshy, swollen at the base, Fronds tripinnate; pinnae swollen at base; pinnules short-stalked, swollen, oblong or lanceolate; veins simple or forked, free. Sori linear-oblong, dorsal; sporangia dehiscing along slits on the ventral surface; spores tetrahedral.

Some consider all taxa as varieties of one species, others divide this genus into over 100 species; one species in Nagaland.

Angiopteris evecta (Forst.) Hoffm., Comm. Soc. Reg. Gott. 12: 29, t. 5, 1796; Bedd., Ferns Brit. India 460, t. 385. 1883; Holttum, Fl. Malaya 3: 44. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 34. 1982.

Polypodium evectum Forst., Prodr. 81. 1786.

(Plate 20).

Terrestrials. Rhizome erect, broad, massive, fleshy, pink inside. Stipe up to 1 m long, smooth, green, swollen at base, with small, brown scales and minute hairs. Fronds 1.5 - 3 m long, bipinnate; pinnae up to 1 m long, jointed to the main rachis, wide spreading, swollen at base; pinnules 10 - 25 x 1 - 3 cm, stalks 0.3 cm long, swollen; lamina lanceolate, acuminate, serrate or toothed, particularly towards the apex; veins simple or 2-forked, nearly parallel. Sori about 0.2 cm long, arranged in two close rows; sporangia 7 - 15 in each sorus, which is boat-shaped, dehiscing along slits on the vertical surface; spores hyaline, tetrahedral.

Common in dense natural forests, specially near water courses. One of the very variable species depending upon the habitat.

Fertile: February - November.

Distribution: JAPAN, TROPICAL AUSTRALIA, NEW CALEDONEA, MADAGASCAR, POLYNESIA, MALAYSIA, INDIA - Meghalaya.

Specimens examined: Jamir 7053 Changki (Mokokchung dist., 1000 m); 6652 Mon (Mon dist., 898 m); 6672 Tejit (Mon dist., 100 m).

7. OSMUNDACEAE

Terrestrial, perennial herbs. Rhizome short, erect or semi-erect, densely covered by persistent leaf bases; scales absent. Stipes tufted, firm, erect, shining, glabrous, bearing a stipule-like outgrowth at the base. Young fronds circinate; mature fronds pinnate to bipinnatifid, dimorphic or fertile and sterile fronds separate, spirally arranged; rachis very narrowly winged; lamina bipinnate, lanceolate; pinnules dark brown, coriaceous; veins free, forked. Sporangia brown, in clusters, on specialised, reduced leaflets, usually forming a panicle; development of sporangia simultaneous; annulus absent; spores trilete. Gametophytes monoecious, elongated, dark green, fleshy.

About 3 genera, 1 in Nagaland.

Osmunda

Linn., Sp. Pl. 2: 1063. 1753; Gen. Pl. ed. 5. 484. 1754; Copel.,Gen. Fil. 21. 1947.

Terrestrial, perennial herbs. Rhizome short, erect or semi-erect, densely covered by leaf bases. Stipes tufted, glabrous, shining; fronds pinnate to bipinnatifid, dimorphic, spirally arranged; lamina bipinnate, lanceolate; pinnules coriaceous; veins free, forked. Sporangia in clusters, brown forming usually a panicle; annulus absent; spores trilete.

About 20 species, 1 in Nagaland.

Osmuda regalis Linn., Sp. Pl. 1065. 1753; Clarke in Trans. Linn. Soc. ser. 2 (Bot.). 1: 583. 1880; Bedd., Handb. Ferns Brit. India 450, t. 276. 1883 et Ferns South India 26, 1863; Panigrahi & Dixit in J. Ind. Bot. Soc. 48: 95. 1969; Baishya & Rao, Ferns & Fern-allies Meghalaya 36. 1982.

(Plate 21)

Terrestrials. Rhizome covered by persistent leaf bases, 8 x 2 cm, erect or semi-erect, scales absent; roots fibrous, dark brown, wide spreading. Stipes firm, erect, 15 - 25 cm long, shining, glabrous, tufted. Fronds 20 - 40 x 15 - 25 cm, bipinnate, dimorphic; fertile and sterile separate; sterile pinnae opposite, short stalked with 11 - 15 pinnules. Pinnules sessile or minutely stalked, opposite or subopposite, 2.5 - 6 x 1 - 3 cm, ovate or oblong, more or less unequal at base, obtuse or acute at apex, margin finely serrulate; venation free, 1 - 2 forked. Fertile pinnules separate, forming a panicle, smaller than or equal to sterile fronds. Sporangia massive, brown, forming clusters; spores trilete, spherical, spinulose.

Not common; in moist, shady forest cleared areas, and along road sides in shady places.

Fertile: February - October.

Distribution: Throughout the world at 1000 to 5,300 m altitude, BHUTAN, INDIA-Western ghats; Kumaon, Meghalaya, between 1200 - 1800 m altitude, Assam and Arunachal Pradesh.

Specimens examined: Jamir 7053 Phek .

8. PLAGIOGYRIACEAE

Terrestrials. Rhizome short, stout, erect, cylindrical, covered with overlapping leaf bases; vascular system dictyostelic. Stipes wide, flattened at the base with a triangular or tetragonal ridge, wart-like aerophores usually present on each side of the ridge, neither scaly nor hairy, but young stipes with glandular, twisted hairs. Fronds dimorphic, tufted; fertile fronds longer than the sterile ones with much narrower pinnae; lamina deeply pinnatifid to pinnate; veins free, simple or once forked. Sori discrete, circular, superficial on the whole length of the lamina except the rachis and midrib; sporangia long stalked; annulus complete, oblique, opening laterally; paraphyses mixed with the sporangia; spores trilete, round or triangular, exine grannulose, verrucose.

Only one living genus.

Plagiogyria

(Kunze) Mett., Farng., 11. Plagiogyria, Abh. Senkenb. Naturf., 275. 1858; C. Chr., Ind. Fil. 495. 1906; Copel., Gen. Fil. 93. 1947.

Characters of the family.

About 50 species; 4 species in Nagaland.

K E Y T O S P E C I E S

1a. Fronds with terminal leaflet simple, similar to lateral pinnae; pinnae sessile or nearly so. . . . . *euphlebia*

1b. Fronds with terminal leaflet pinnatifid, different from the lateral pinnae; pinnae sessile or stalked.

2a. Pinnae 4 - 6 cm apart with white to bluish-white powdery substance on the lower surface; . . . . . *distanta*

2b. Pinnae close, not covered by such substance on the lower surface.

3a. Stipe and rachis quadrangular with membranous wings on the angles; midrib with a gland-like swollen structure at the base near the attachment on the ventral surface . . . . . *gigantea*

3b. Stipe and rachis angular but without distinct wings; midrib otherwise . . . . . *scandens*

Plagiogyria distanta Dixit et Das in Proc. Ind. Acad. Sci. 90(4): 396. 1981.

P. glaucescens Ching var. *arguta* Ching Acta Phytotax 7(2): 151. 1958.

Rhizome short, stout, erect to semi-erect, clothed with persistent old leaf bases; stipes of sterile fronds up to

30 cm or more long, dark-brown, stramineous; aerophores present on both stipe and on rachis at the base of pinnae, except at apical part; lamina 25 - 45 x 15 - 20 cm, oblanceolate, pinnate; lateral pinnae numerous, 20 - 33 pairs, opposite or alternate, with a terminal pinnatifid leaflet; lower pinnae distant, 3 - 5 cm apart; upper ones gradually close, subsessile to sessile, erecto-patent, largest pinnae up to 10 x 1 cm, linear-lanceolate, oblique, truncate at base, gradually tapering into a caudate acuminate apex, margin finely serrulate or serrate; texture chartaceous or subcoriaceous, upper surface yellowish green, lower surface more or less covered with white powdery substance; midrib distinct on lower surface, simple or forked once. Fertile pinnae up to 10 x 0.5 cm, narrowly linear, ercto-patent; shortly subcordate or truncate at base, usually sessile or subsessile; sporangia acrostichoid; spores oval, trilete, brownish to pale-yellowish.

Frequent in dense forests as an undergrowth.

Fertile: October.

Distribution: CHINA (Yunan), INDIA - North east India.

Specimens examined: Jamir 7086 Japvo (Kohima dist., 1800 m).

Plagiogyria euphlebia (Kuntze) Mett. Farn. Plagiog. 10. 1857; Hook. Sp. Fil. 3: 20. 1860; Bedd., Ferns Brit. India 129. 1883; Baishya & Rao, Ferns & Fern-allies Meghalaya 48. 1982.

Lomaria euphlebia Kuntze in Bot. Zeit. 6: 521. 1848.

(Plate 22)

Rhizome short, stout, erect or somewhat prostrate, covered by old leaf bases, aerophores restricted to leaf bases on upper stipe and rachis. Stipes 20 - 40 cm long, tufted, erect with 2-3 aerophores on each side of ridges at base. Circinate vernation fleshy with yellowish glands. Sterile lamina 25 - 50 x 15 - 25 cm, pinnate; the lower pinnae sessile, the upper most adnate and the terminal with one or more lobes at base; pinnae 10 - 17 x 1.5 - 2.2 cm, linear-lanceolate, cuneate at base, shortly stalked, margin serrate, apex acuminate; texture subcoriaceous; veins prominent, simple or forked; fertile pinnae 5 - 15 x 0.2 - 0.5 cm, narrowly linear, cordate at base, shortly petiolate. Sporangia acrostichoid, with septate, brown hairs; annulus 18 - 20 celled; spores oval, often pyramidal, yellowish, papillate.

Very common, on moist humus soils in open or shady places, sometimes grows forming dense populations eliminating other species from the area.

Fertile: February - October.

Distribution: KOREA, JAPAN, TAIWAN, CHINA, BURMA, THE PHILLIPENES, NEPAL, AUSTRALIA, INDIA- Meghalaya at 1230 - 1830 m elevation.

Specimens examined: Jamir 7190 Meluri (Phek dist., 1768 m).

Plagiogyria gigantea Ching, Lingnan Sc. Journ. 15: 275. 1936; Acta Phytotax. Sin. 7(2): 148.t. 36. f. 1. 1958; Dixit & Das, Proc. Ind. Acad. Sci. 90: 382. t. 13.1981; (Plate 23)

Terrestrials. Rhizome short, stout, erect to ascending, covered by old leaf bases. Stipes about 25 - 45 cm long, tufted, rather stout, erect, with one aerophore (swollen gland-like) at the base on the right side of the ridges. Sterile lamina 30 - 65 x 15 - 30 cm, pinnate; lateral pinnae numerous, subopposite or alternate, sessile or subsessile, with a terminal pinna which is more lobed at base; largest pinnae 15 - 20 x 1 - 1.8 cm, linear-lanceolate, abruptly truncate at base, sessile, gradually tapering into caudately acuminate apex, margin finely serrate throughout, except the apical part which is more sharply and deeply toothed; texture coriaceous; rachis angled with membranous wings. Veins prominent, simple or forked. Fertile pinnae 18 - 25 x 0.5 - 0.8 cm, narrowly linear, rather cordate at base, subsessile, midrib prominent; sporangia throughout the pinnae, except midrib, acrostichoid, with septate, brown hairs, annulus of 15 - 20 thickened cells; spores oval, 3-lobed, hyaline, pale yellowish.

Very common, on moist humus soils on hill slopes and also in open jhummed forests, often forming pure strands.

Fertile: May - June.

Distribution: CHINA, EASTERN INDIA - This has been reported as a new record for India by Dixit & Das (loc. cit.) based on a collection of Panigrahi (No. 6270, ASSAM) from Arunachal Pradesh. The present collection forms a second report from India.

Specimens examined: Jamir 7170 Helipong forests (Tuensang dist.)

Plagiogyria scandens Mett., Abhandl. d. Senckenb. naturf. Ges. 2: 273. t. 4, f. 21. 1858; Dixit & Das in Proc. Ind. Acad. Sci. 90: 381. 1981.

P. pycnophylla sensu Bedd., Ferns Brit. India t. 52. 1865; et Handb. Ferns. Brit. India 129. 1883; proparte; pro parte; Panigrahi in Bull. Bot. Surv. India 2: 313. 1961 (non Mett. 1858).

P. communis Ching, Acta Phytotax. Sin. 7(2): 147. t. 35, f. 2. 1958; Baishya & Rao, Ferns & Fern-allies Meghalaya 47. 1982. (Plate 23A).

Rhizome short, erect, woody, clothed by persistent leaf bases, and wiry roots. Stipes 15 - 30 cm long, tufted, fleshy erect, with one aerophore at the base on the right side of the ridge. Sterile lamina 25 - 55 x 10 - 18 cm, pinnate; the

lower and upper pinnae short petiolate; the upper pinnae sessile and the uppermost one or more adnate; the terminal pinnae usually with one or more lobes at base; pinnae 8 - 12 x 0.5 - 1.5 cm, linear-lanceolate, shortly petiolate, margin serrate, caudately acuminate at apex, base obtuse or truncate; veins numerous, simple or forked. Fertile pinnae 5 - 10 x 0.2 - 0.5 cm, shortly petiolate; indusia absent. Sporangia with 10 - 17-celled annulus; spores 3-lobed, hyaline, smooth, pale yellowish.

Common in open as well as in moist shady places on hills.

Fertile: February - November.

Distribution: CHINA, JAVA, NEPAL, BHUTAN up to 1830 m elevation; INDIA- Meghalaya 1220 - 1830 m elevations.

Specimens examined: Jamir 7145 Kohima (Kohima dist., 1445 m).

9. GLEICHENIACEAE

Terrestrials. Rhizome wide-creeping, rather slender, dorsiventral, covered with hairs or fringed scales; stipule-like appendages present on the main rachis; vascular system protostelic or solenostelic. Stipe distant, slender, terete, wiry; vascular strand 'C'-shaped in cross section. Fronds repeatedly pseudo-dichotomously branched or simple pinnate, with dormant apical buds at the dichotomies, which give rise to another long rachis with side branches at the growing season; apical buds protected by hairs or scales and often with stipule-like bracts; leaflets or ultimate branches pinnatifid or bipinnatifid, lobed almost to costa; venation circinate; veins free, simple or forked. Sori small, round, dorsal, exindusiate and superficial or terminal on the veinlets of leaf segments; sporangia short-stalked or subsessile, 2 - 10 per sorus; annulus complete, oblique, tranversely opening by vertical slits; spores many, smooth, tetrahedral, trilete, or monolete.

A family of 1 - 8 genera depending on the concept of author; 2 genera in Nagaland.

K E Y T O G E N E R A

Fronds repeatedly, dichotomously forked; rhizome clothed with multicellular hairs; veins forked twice or more . . . . . 1. Dicranopteris

Fronds forked once or rarely twice; rhizome not hairy; veins forked only once near the costa . . . . . 2. Gleichenia

Dicranopteris

Bernhard, Schrader's Neues Journ. 1: 26, 28. 1806; Copel.,Gen. Fil . 28. 1947.

Rhizome long, slender, wide-creeping, densely covered with brown scales and multicellular hairs, which are straight, stellate or irregularly branched. Fronds 2 - 2.5 m long, with a slender stipe; repeatedly dichotomously branched, or simple pinnate, with dormant buds covered by stiff hairs and by small stipule-like lobed bracts; ultimate branches deeply pinnatifid, almost reaching the costa; veins forked more than once. Sori without paraphyses; sporangia obovate to oval; annulus brown, shining, dehiscing vertically. Spores monolete or trilete, smooth.

Only species in Nagaland: Dicranopteris linearis (Burm.f.) Underwood.

There are many varieties of this species, all of which show much variation; Biosystematic studies are essential to establish the correct varieties under this. Two varieties are however, recognised in Nagaland, which can be separated as per the following key.

K E Y T O V A R I E T I E S

Fronds glabrous on the lower surface; more than twice forked; stipules surrounding the apical bud broad, ovate; pinnules up to 6 cm long . . . . . linearis var. montana

Fronds clothed with dark-brown or reddish-brown hairs beneath; stipules small, clefted; pinnules up to 2.5 cm long . . . linearis var. . altissima

Dicranopteris linearis (Burm.f.) Underwood in Bull. Torrey Bot. Club. 34: 250. 1907; var. altissima Holttum, Fl. Malaya 2: 69. 1954; et in Reinwardtia 4: 276. 1957; Tagawa in Acta Phytotax. Geobot. 2: 83. 1966; Baishya & Rao, Ferns & Fern-allies Meghalaya 40. 1982.

(Plate 24)

Rhizome up to 0.4 cm across, long-creeping, densely covered by minute, multicellular, reddish-brown hairs; scales absent. Stipe 15 - 30 x 0.1 - 0.3 cm, slender, straggling, rigid and smooth. Fronds up to 2 m long, pinnate or dichotomously branched; apical buds covered by brown hairs and usually by small stipule-like, lobed bracts; ultimate branches 12 - 20 x 2 - 8 cm; deeply pinnatifid, nearly reaching the costa, linear or subulate, 0.4 - 4 x 0.2 - 0.4 cm, densely covered by brown hairs; costa and costules sparsely hairy; veins 2-forked, prominent, free. Sori small, globose, without paraphyses; spores numerous, trilete; exine deeply grooved.

Abundant in open forests and in forest cleared areas forming dense thickets. Often associated with the next variety.

Fertile: July - October.

Distribution: MALAYA, INDIA - Meghalaya.

Specimens examined: Jamir 6632 Mon, (Mon dist., 898 m); 6201, 6243 Changki (Mokokchung dist., 1000 m); 6401 Tejit (Mon dist., 100 m).

Dicranopteris linearis (Burm.f.) Underwood. var. montana

Holttum in Reinwardtia 4: 276. 1957; et in Fl. Malaya 2: 68 (ed. 2). 1968; DeVol in Fl. Taiwan 1: 90 (ed.2). 1980; Bashya & Rao, Ferns & Fern-allies Meghalaya 40. 1982.

Polypodium linearis Burm.f., Fl. Ind. 235, t. 67, f. 2. 1768.

Gleicheinia linearis (Burm.f.) Clarke in Trans. Linn. Soc. ser. 2 (Bot.) 2: 428. 1880; Bedd., Fern Brit. India 4, t. 1. 1883.

Rhizome up to 0.6 cm across, long-creeping. Stipes 50 - 150 x 0.4 - 0.5 cm, slender, smooth. Apical dormant buds covered by ovate stipules, margin entire, glabrous, up to 0.3 x 1.5 cm. Fronds up to 2.5 m long, simple pinnate or dichotomously branched, glabrous, somewhat glaucous, and with reddish-brown hairs beneath; accessory reflexed branches at the base of all ultimate dichotomies or a pair of stipulate pinnae at the base of dichotomy; lower dichotomies usually without

accessory branches; axillary buds covered by hairs, but stipule-like bracts absent except on the lowest forks; ultimate branches 12 - 25 x 4 - 11 cm, deeply pinnatifid, nearly reaching the costa; spinnules 1 - 7 x 0.5 - 0.8 cm, linear to subulate, costa and costules raised, glabrous; veins forked in groups, veinlets 3 - 9, free. Sori small, globose, yellowish-brown, sporangia 9 - 25 per sorus, arranged in a line along either side of the costule; spores numerous, minute, hyaline.

Common in open places in forests and on open hilly slopes. Frequently associated with the former taxon, but more common than the former variety.

Fertile: July - November.

Distribution: SRI LANKA, MALAYA, INDONESIA, TAIWAN, INDIA - Meghalaya.

Specimens examined: Jamir 6105 Kohima (Kohima dist., 1445 m).

Gleichenia

Smitth, Mem. Acad. Turin. 5: 419. 1793; C. Chr., Ind. Fil. 320. 1906; Copel.,Gen. Fil. 26. 1947.

Rhizome long, wide-spreading, tough, dichotomously branched, clothed with deciduous scales; hairs absent. Stipe long, solid, hard, erect or slender, hairy or not; rachis usually forked once, often twice; dormant apical buds in between the

forkings, protected by hairss or scales and stipule-like bracts. Fronds bipinnate, paleaceous, stellately hairy on costa, rachis and on apical buds; veins free, forked. Sori small, round, exindusiate; sporangia subsessile; annulus oblique, transverse; spores numerous, smooth, trilete.

A genus of about 100 species; 2 in Nagaland.

K E Y T O S P E C I E S

Stipe hairy; palea 13 - 14 cells broad;
stellate hairs with 5 - 6 arms . . . . longissima
Stipe glabrous; palea 2 - 3 cells broad;
stellate hairs with 10 - 15 arms . . . volubilis

Gleichenia longissima Blume, Enum. Pl. Jav. Fil. 250. 1828; Baishya & Rao, Ferns & Fern-allies Meghalaya 41. 1982.

G. gigantea Wall. ex Hook. et Baker; Bedd., Ferns Brit. India t. 30. 1865; Holttum, Fl. Malaya 2: 67 (ed.2). 1968; G. glauca (Thunb.) Hook., Sp. Fil. 1: 4. t. 3, 1844 (non Sw.); Clarke in Trans. Linn. Soc. ser. 2 (Bot.) 1: 428. 1880.

Polypodium glaucum Thunb., Fl. Jap. 338. 1784.

(Plate 25)

Rhizome long, up to 0.7 cm across, brown scaly; scales up to 0.9 x 0.2 cm, lanceolate; hairs absent. Stipe 40 - 70x 0.4 - 0.7 cm, erect, covered with 5 - 6-armed stellate hairs.

Fronds with large, spreading branches; primary branches 8 - 140 x 15 - 35 cm, deeply bipinnatifid; secondary branches (leaflets) deeply pinnatifid, 1.5 - 3 cm apart, alternate or often opposite; leaflets 9 - 20 x 1.5 - 2.5 cm, each lobe separated by the narrow sinuses; usually at right angles to the costa, rounded or notched at the apex, glaucous, sparsely covered with pale, lax, stellate hairs; veins free, once forked; costa and costules pubescent, grooved beneath, slightly raised on the upper surface, covered by hairs; palea 13 - 14-celled, margin ciliated; lowest leaflets short, very near to the main rachis, up to 1 - 5 cm long, bipinnatifid with narrow lobes; apical buds densely covered with brown, cordate-lanceolate scales, up to 0.7 cm long. Sori yellowish-brown, between the costule and edge of lobe; sporangia 2 - 5 per sorus, globose; spores triangular, pale brown, hyaline.

Abundant, along roadsides and open places forming thickets on hilly slopes. Frequently associated with other larger terrestrials ferns.

Fertile: July - November.

Distribution: MALAYSIA, POLYNESIA, AUSTRALIA (mostly found between 860 - 2000 m altitudes); INDIA - Meghalaya.

Specimens examined: Jamir 6079 Kohima (Kohima dist., 1445 m).

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

Rhizome long, tough, up to 0.6 cm across, brown scaly; scales 0.3 - 0.8 cm long, lanceolate. Stipes 60 - 100 x 0.5 - 0.9 cm, erect, woody, solid, glabrous or with brown scales at base. Fronds wide spreading, branched; primary branches 100 - 150 x 20 - 40 cm, bipinnatifid; secondary branches deeply pinnatifid, 1.5 - 3.5 cm apart, alternate or opposite; leaflets or segments small, 10 - 22 x 1.5 - 3 cm, oblong-acute, acute each lobe separated by a narrow sinus, rounded or notched at the apex, glaucous, sparsely covered with pale, lax, stellate hairs; veins free, once forked; rachis, costa and costules raised on the ventral surface, densely covered by palea and hairs; palea 2 - 3-celled, broad with ciliated margin; lowest leaflets short, very near to the main rachis, up to 1 - 7 cm long, bipinnatifid with narrow lobes; stipule-like apical dormant buds present on the main rachis, clefted, densely covered with bright, brown, cordate-lanceolate scales, up to 1 cm long; stellate hairs on palea with 10 - 13 arms. Sori small, yellowish-brown, globose, submarginal; spores hyaline, pale brown.

Fery common, along roadsides and in open grasslands forming dense patches. Sometimes along forest margins.

Fertile: February - October.

Distribution: INDIA - North-east India.

Specimens examined: Jamir 6320 Shamator (Tuensang dist. 1875 m).

10. GRAMMITACEAE

Small epiphytes or often on moss covered rocks. Rhizome short-creeping or ascending with solenostelic or dictyostelic vascular cylinder; scales opaque, shining, brown, often with stiff, unicellular hairs. Stipes tufted, usually not articulate to rhizome, clothed with dense, brown, soft, spreading hairs. Fronds simple, pinnate or rarely bipinnate; pinnae entire, toothed or rarely dissected to veins; venation usually free, often slightly anastomosing; patent hairs borne on both surfaces of lamina. Sori round, oval or linear, dorsal or marginal, superficial or immersed; sporangia long-stalked; often mixed with one or more stiff, acicular hairs; annulus of 10 - 13 thick walled cells; spores tetrahedral, small; exine verrucoid or granulose.

About 12 genera; only 1 in Nagaland.

Ctenopteris

Blume, Fl. Jav. Fil. 2: 132. 1828; C. Chr., Ind. Fil. 1906; Copel., Gen. Fil. 218. 1947.

Epiphytes on mossy tree trunks. Rhizome short, suberect, often creeping, scales opaque. Stipe tufted or approximate, usually not articulate to rhizome. Fronds usually pinnatifid or pinnate, often bipinnate; pinnae broadly adnate to the costa, lower pinnae gradually reduced; stipe, rachis and surfaces covered by reddish-brown hairs; veins usually not prominent,

free. Sori dorsal, terminal on the veins, superficial or immersed in cavities or near the margin; paraphyses absent.

A genus of about 200 species; only 1 species in Nagaland.

Ctenopteris subfalcata (Blume) Kunze in Bot. Zeit. 6: 120. 1848; DeVol in Fl. Taiwan 1: 220. (ed.2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 77. 1982.

Polypodium subfalcatum Blume, Enum. Pl. Jav. 186, f. 87 A & B, 1828; Clarke in Trans. Linn. Soc. ser. 2 (Bot.) 1: 549. 1880; Bedd., Handb. Ferns Brit. India 314, t. 168. 1883.

(Plate 26)

Rhizome short, suberect, scaly; scales up to 0.2 cm long, opaque, ovate, brownish; roots small, spreading, covered by soft, pale brown hairs. Stipes up to 0.5 cm long, tufted, Fronds 3 - 10 x 1 - 2 cm, lanceolate, deeply pinnatifid, pinnae adnate, gradually decurrent at base, lower pinnae reduced, margins serrate, texture soft; rachis, stipe and both surfaces of lamina covered by brownish-yellow hairs; veinlets simple, not reaching the margin. Sori small, round, dorsal, superficial on terminal veins, borne on each costule or lobe of the pinnae.

Very rare collected only once on mossy tree trunks in dense, evergreen forests.

Fertile: May - June.

Distribution: MALAYSIA, SOUTH CHINA, TAIWAN, SRI LANKA, INDIA-Nilgiris, Himalayas and North east India.

Specimens examined: Jamir 7133 Kohima (Kohima dist., 1445 m).

11. LOXOGRAMMACEAE

Epiphytes. Rhizome short, creeping; roots densely covered with dark brown roothairs; young parts clothed with brown, entire scales. Stipe very short and with a ring of many slender vascular strands. Fronds glabrous, simple, narrow, entire, somewhat fleshy, thick, coriaceous, not articulate to rhizome; midrib prominent, veins immersed, lateral veins ill-defined, forming irregular series of areoles, oblique to the midrib, veinlets free, without included veinlets, Sori elongate, oblique to the midrib, confluent in between lateral veins; without peltate paraphyses; sporangia stalked; annulus 12- 16-celled; spores monolete or trilete; exine granular.

A family with 2 genera; 1 in Nagaland.

Loxogramme

(Blume) Presl, Tent. Pterid. 214. 1836; C. Chr., Ind. Fil. 410. 1906; Copel. Gen. Fil. 217. 1947.

Small ferns growing on moss covered rocks or tree trunks. Rhizome short, creeping; roots covered by dark-brown hairs Stipe very short; fronds glabrous, narrow, entire, fleshy, coriaceous, not articulate to the rhizome; midrib prominent, veinlets free, without included veinlets. Sori elongate, oblique, confluent to lateral veins; sporangia short stalked; annulus 10 - 16-celled; spores monlolete or trilete.

Species about 35; 3 in Nagaland.

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K E Y T O S P E C I E S

1a. Fronds 1 - 4 x 0.3 - 1 cm, spathulate, narrowed into a long stipe . . . . *grammitoides*

1b. Fronds larger than above, various in shape.

2a. Fronds 0.5 - 1.5 cm wide; sori 0.6 - 1.2 cm long; almost parallel to the midrib. . . . . *lanceolata*

2b. Fronds more than 1.5 cm wide; sori 2 to 3.5 cm long, distinctly oblique to the midrib.

3a. Rhizome scales linear, terminating into hair-like apices; spores oval to reniform . . . . . *avenia*

3b. Rhizome scales broad, lanceolate-acuminate; spores spherical . . . *involuta*

Loxogramme avenia (Blume) Presl., Tent. Pterid. 215. 1836; Bedd., Handb. Ferns Brit. India 393. t. 229, 1833; Holttum, Fl. Malaya 2: 167. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 66. 1982.

Grammitis avenia Blume, Enum. Pl. Jav. 117. 1828.

Epiphytes. Rhizome 0.2 - 0.6 cm across, short creeping, with narrow, entire, linear, brownish scales; scales up to 0.6 cm long; roots crowded, covered by numerous, brown root-hairs. Stipes short, up to 2.5 cm long, lamina about 20 - 50

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x 3 - 5.5 cm, gradually widening upwards from base, widest above the middle and again narrowed gradually to an acuminate apex; texture slightly fleshy, hard (when dried); midrib flat on lower surface and prominently raised on upper surface; veins reticulate with free veinlets in some of the areoles, without prominent costules. Sori linear, confluent, in between lateral veins, parallel, oblique, nearly reaching the margin (from midrib); sporangia stalked, paraphyses absent; annulus 10 - 16-celled; spores bilateral, smooth.

Not common; on moss-covered tree trunks in dense evergreen forests; often in association with polypodiaceous members.

Fertile: July - October.

Distribution: SUMATRA, PHILIPPINES, MALAYA, INDIA - Northeast India.

Specimens examined: Jamir 6355 Shamator (Tuensang dist., 1372 m); 6582 Wokha (Wokha dist., 1314 m).

Loxogramme grammitoides (Bak.) C. Chr., Ind. Fil. Suppl. 2. 1917, Suppl. 3: 125. 1934; Bhargavan & Joseph, in New Botanist 5: 43-44. 1978.

Gymnogramme grammitoides Baker in Journ. Bot. 27: 178. 1889.

Polypodium grammitoides (Bak.) Diels Engl. Jahrb. 29: 205. 1900.

(Plate 27)

Rhizome up to 0.1 cm wide, wide-creeping, slender, scaly; scales linear, ovate, lanceolate-acuminate, paleaceous, dull brown, numerous, peltate, margin entire, multicellular, cells uniformly thick-walled except at the palce of attachment. Fronds dimorphic; fertile longer than sterile ones, coriaceous, glabrous on both surfaces, costate; costa up to middle or nearly to the tip of lamina, more raised or distinct on the upper side; veins usually obscure, forming irregular arolae without free included veinlet. Fertile fornds 2 - 4 x 0.3 - 0.6 cm, spathulate, gradually narrowed towards the long stipe, rounded at apex, margin entire. Sterile fronds shorter than fertile ones, up to 1 - 2 x 0.2 - 0.7 cm, obovate to oblanceolate in outline, tapering towards short stipe. Sori up to 0.8 cm long, elongate, oblique to costa, immered; 2 - 4 rows on either side of the costa, extending from costa to almost nearly to the margin, spreading on maturity; exindusiate; spores globular, pale-brown.

Very rare, grows on rocks in moist shady places in forests forming cushions with entangled masses. This has been reported as a new record for India by Bhargavan & Joseph, (loc.cit.) from Arunachal Pradesh. The present collection therefore forms the second report and firmly establishes its occurrence in north-east India.

Fertile: October.

Distribution: CHINA, JAPAN, INDIA- Arunachal Pradesh.

Specimens examined: Jamir 6698 Tijit (Mon dist.,200 m).

Loxogramme involuta (D.Don) Presl., Tent. Pterid. 215. 1836; Bedd., Handb. Ferns Brit. India 393. t. 228. 1883; Baishya & Rao, Ferns & Fern-allies Meghalaya 66. 1982. Grammitis involuta D. Don, Prodr. Fl. Nepal 14. 1825; Clarke in Trans. Linn. Soc. ser. 2 (Bot.) 1: 570. 1880.

(Plate 28)

Rhizome stout, up to 0.5 cm across, short-creeping, scales broad, lanceolate, brownish, up to 0.8 cm long; roots covered by numerous brown hairs. Stipes up to 4 cm long; lamina about 20 - 40 x 2.5 - 5 cm, lanceolate, apex acuminate, margins entire, gradually narrowed at base to a short, broad, compressed stipe; texture thick, coriaceous but flaccid, glabrous on both surfaces; veins obscure, areoles copious with free included veinlets. Sori linear, usually close and parallel, oblique nearly reaching the margin from midrib; sporangia stalked, yellowish-brown; annulus 9 - 15-celled; spores spherical, dark brown, exine smooth.

Not common; on moss-covered tree trunks in dense evergreen forests; sometimes on rocks in forests, specially near water courses.

Fertile: July - October.

Distribution: MALAYSIA, SUMATRA, NEW GUINEA, POLYNESIA, SRI LANKA, INDIA - Nilgiris, 1,500 - 2,500 m elevation; Himalayas 600 - 2130 m elevations, Northeast India.

Specimens examined: Jamir 6421 Tijit (Mon dist., 200 m).

Notes: Loxogramme involuta and L. avenia are quite similar; however, the former differs from the latter in having broad-lanceolate, lamina, with narrowly acuminate apex, while the latter have lamina which are narrowly linear-lanceolate, terminating in hair-like apices. Biosystematic studies are needed to understand the correct status of these two species.

Loxogramme lanceolata (Sw.) Presl, Tent. Pterid. 215, t.9, f. 8, 1836; Bedd., Handb. Ferns Brit. India 2392. 1833; et Ferns Brit. India 17, t. 51. 1863.
Grammitis lanceolata Sw. in Schrard. J. Bot. 1800, 2: 18. 1801. *(Plate 28A).*

Epiphytes. Rhizome stout, up to 0.4 cm thick, short-creeping; rhizome scales small, linear-lanceolate, brownish, up to 0.5 cm long; roots covered by brown, small hairs. Stipes short, up to 2 cm long; lamina about 6 - 25 x 0.5 - 2 cm, linear-lanceolate, entire, acute at apex, gradually narrowed to a very short stipe; texture thick, coriaceous but flaccid, glabrous on both surfaces; veins obscure, costal areoles many, with or without free, included veinlets, midrib slender Sori shorter, nearly parallel and nearly reaching the margin; sporangia short stalked, greenish-brown; spores spherical, brown, smooth.

Abundant, on moist tree trunks in natural evergreen forests.

Fertile: May - October.

Distribution: CHINA, JAPAN, FIJI, SAMOA, AFRICA, SRI LANKA, INDIA - Southern and Western India up to 2500 m elevation; Eastern India:- Meghalaya 120 - 1500 m elevation.

Specimens examined: Jamir 7159, 6121 Kohima (Kohima dist., 1445 m); 6359 Shamator (Tuensang dist., 1372 m); 6522 Wokha (Wokha dist., 1314 m).

12. POLYPODIACEAE

Predominantly epiphytes, some terrestrials and on moss-covered rocks. Rhizome creeping or rarely ascending, dictyostelic, scales usually peltate, adpressed, rarely clathrate or hair-like. Fronds simple (not lobed) pinnatifid, pinnate or rarely digitately lobed, glabrous, or hairy or scaly, usually coriaceous. Stipes articulate to rhizome; veins prominent, reticulate or netted, usually with free, included veinlets ending on distinct hydathodes, often hidden. Sori round, oval or linear, exindusiate, peltate, clathrate; paraphyses often present, sometimes fused to form coenosori; sporangia stalked; annulus incomplete, with 10 - 20 indurated cells; dehiscing by transverse slits; spores bilateral, rarely tetrahedral, without perispore.

A family of about 65 genera; 16 in Nagaland.

K E Y T O G E N E R A

1a. Epiphytes with distinct humus collecting fronds.

2a. Humus collecting fronds distinct; not fused with fertile fronds, pinnae articulate on rachis . . . . . 16. Drynaria

2b. Humus collecting portion represented by modified, broadened leaf bases; pinnae not articulate on rachis . . 15. Pseudodrynaria

1b. Epiphytes or terrestrials, without humus collecting fronds.

3a. Lamina simple.

4a. Fronds dimorphic.

5a. Terrestrials; sporangia acrostichoid.

6a. Primary veins obscure or wanting.. ..... 12. Leptochilus

6b. Primary veins conspicuous . .13. Paraleptochilus

5b. Epiphytes; sporangia in long coenosori.

7a. Fronds stellate paleate throughout; coenosori marginal . . . . 7. Drymoglossum

7b. Fronds without stellate palea; coenosori not marginal; fertile fronds linear and sterile fronds obovate or orbicular. . . 5. Lemmaphyllum

4b. Fronds monomorphic.

9a. Sori linear, fronds articulate on rhizome; lateral veins distinct . . 14. Colysis

9b. Sori round; fronds articulate or not.

10a. Sori covered with peltate, clathrate scales, at least when young.

11a. Venation distinct . . . . 2. Neocheiropteris

11b. Venation not prominent.

12a. Stipes approximate . . . . 3. Lepisorus

12b. Stipes 2 - 3 cm apart. . . .4. Lepidogrammitis

10b. Sori not covered with such scales.

13a. Sori superficial . . . . . 9. Crypsinus

13b. Sori sunken . . . . . 10. Microsorum

3b. Lamina pinnate or pinnatifid.

14a. Fronds ferruginous stellately hairy; veins obscure . . . . . 6. Pyrrosia

14b. Fronds not stellate hairy; veins obscure or distinct.

15a. Sori linear forming coenosori.

16a. Terrestrials; rhizome dorsiventral . 11. Kaulinia

16b. Epiphytes; rhizome terete or nearly so . . . . . 14. Colysis

15b. Sori round or oval, not forming coenosori.

17a. Fronds deeply pinnatifid, not articulate to rachis; sori in single row on either side of costa . . . . . 1. Polypodium

17b. Fronds pinnate; pinnae articulate to rachis; sori in 2 - 4 rows between lateral veins . . . . . 8. Arthromeris

1. Polypodium

Linn., Sp. Pl. 2: 1082. 1853; C. Chr., Ind. Fil. 506. 1906; Copel., Gen. Fil. 180. 1947.

Epiphytes or terrestrials. Rhizome creeping, more or less densely scaly. Scales clathrate, blackish-brown, peltate; stipes articulate to rhizome. Fronds simple or pinnate or deeply pinnatifid, glabrous or pubescent, or paleate; veins usually reticulate, forming regular areoles with free included veinlets, rarely with prominent, free, forked veins. Sori globose, usually in one row on either side of costa, at the end of included veinlets in the areoles; sporangia stalked; annulus 12 - 18-celled, imcomplete; spores bilateral, hyaline, without perispores.

A genus of about 50 species; 4 in Nagaland.

K E Y T O S P E C I E S

1a. Fronds unipinnate.

2a. Leaves linear-lanceolate, irregularly dentate; terminal leaves not reduced, adnate . . . . . *argutum*

2b. Leaves linear, regularly repand serrate, terminal leaves much narrowd, and free . . *argutum* var. *longifolia*

1b. Fronds pinnatifid.

3a. Rhizome fleshy 1 - 1.5 cm across . . *amoenum*

3b. Rhizome wiry, less than 1 cm across.

4a. Stipes glabrous; rhizome scales ovate, acute, adpressed; pinnae rounded at the tip . . . . . microrhizoma

4b. Stipes sparsely scaly or glabrous; rhizome scales linear, hair-like, spreading; pinnae acute or acuminate . . lachnopus

Polypodium amoenum (J.Smith) Wall. ex Mett. Uber, Trangtt. 1: 80. 1857; Hook. Sp. 5: 24. 1867; Clarke, in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 550. 1880; Bir et al. in New Botanist 1(384): 149. 1974; Dhir, Ferns N.W. Himalayas 118. 1980; DeVol & Kuo, Fl. Taiwan 1: 202 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 70. 1982.

Goniophlebium amoinum J. Smith, in Hook. Gen. Fil. t. 51. 1840; Bedd., Ferns Brit. India 317. 1883.

Epiphytes. Rhizome up to 1 cm wide, creeping, fleshy, densely covered with dark to pale-brown, broad based, lanceolate-subulate scales; scales about 0.5 x 0.2 cm. Stipes 13 - 35 cm long, shining, pale-purplish, articulate to rhizome; lamina 15 - 60 x 12 - 25 cm, simple, deltoid to cordate-oblong in outline, deeply pinnatifid; pinnae numerous, alternate or opposite, deeply cut down nearly reaching the rachis, with a single, apical, lanceolate acuminate lobed similar to the lateral ones; largest pinna or segment up to 12 x 2 cm, narrowly lanceolate, acuminate, adnate at base to a narrow

wing on rachis; margin entire or dentate-serrulate, glabrous on both surfaces, lowest pair of pinnae deflexed; texture submembranous, greenish-brown when dry; veins prominent, reticulate, forming one series of areoles with single included veinlets, ending in dark hydathodes, marginal veins free. Sori up to 0.2 cm wide, rather larger, round, sunk at the end of the included veinlets in a costal areolae; spores oval to bean-shaped with a distinct longitudinal apical marking, yellow, hyaline.

Very common, on both shady as well as exposed tree trunks; rarely on the humus and moss-covered rocks, along roadsides. Very variable with regard to shape of fronds, probably includes many varieties.

Fertile: May - December.

Distribution: CHINA, TAIWAN, BHUTAN, INDIA - Himalayas; Garwhal at 1200 - 3300 m elevation; Meghalaya at 900 - 1800 m elevation.

Specimens examined: Jamir 6082 Kohima (Kohima dist., 1445 m); 6325, 6358 Shamator (Tuensang dist., 1690 m); 6574 Changki (Mokokchung dist., 1000 m); 7947 Zenheboto (Zenheboto dist., 1875 m).

Polypodium argutum Wall. ex Hook., Sp. Fil. 5: 32. 1863; Clarke, in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 551. 1880; Dhyani, Ferns N.W. Himalayas, 121. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 71. 1982.

Goniophlebium argutum (Wall.) J. Smith in Hook. Gen. Fil. t. 52. 1840; Bedd., Ferns Brit. India t. 6, 1865; et Handb. Ferns Brit. India 323. t. 174. 1883; DeVol & Kuo, Fl. Taiwan 1: 178. 1980.

Rhizome 0.5 - 0.8 cm across, wide-crreping, rather stout, densely clothed with linear-lanceolate scales; scales clathrate, blackish-brown, hair-tipped, margin hooked. Stipes 4 - 12 cm long, slender, erect, pale-purplish, shining, with short multicellular hairs; articulate to rhizome, lamina 12 - 50 x 10 - 20 cm, deltoid to obovate-lanceolate in outline; pinnate, glabrous, with a terminal pinna quite similar to the lateral ones, except sometimes bearing a cuneate or short-lobe at the base; lateral pinnae numerous, opposite or subopposite, sessile or adnate; the lowest pair of pinnae somewhat reduced to the above; largest pinnae up to 15 x 2 cm, oblanceolate, sessile or adnate to rachis, truncate or broad at base, gradually tapering to a lanceolate, acuminate apex, margin finely serrate; texture firm, membranous, pale-greenish when dry; veins prominent; only one series of areoles with included veinlets; secondary areoles towards margin absent. Sori small, globose, terminal on the included veinlets inside the areoles, light-brown, sporangia short-stalked; annulus of 10 - 13 cells;

paraphyses clathrate; spores elliptical with distinct loop-like projections on both ends, greenish-yellow, hyaline.

Exceedingly common on moist, moss-covered tree trunks as well as rocks in forests. Extremely variable species.

Fertile: July - October.

Distribution: VIETNAM, CHINA, TAIWAN, PHILIPPINES, BHUTAN, INDIA - Himalayas, Kashmir 1200 - 2700 m elevation, Meghalaya up to 1990 m elveation (Shillong peak).

Specimens examined: Jamir 6116 Kohima (Kohima dist., 1445 m); 6158 Phek (Phek dist., 1000 m); 6230 Changki (Mokokchung dist., 1000 m); 6308, 6325 Morong forests, Sangpor (Tuensang dist., 1314 m); 6529 Wokha (Wokha dist., 1314 m).

Polypodium argutum Wall. ex Hook. var. **longifolia var. nov.**

(Plate 29)

Rhizome up to 1 cm across, wide creeping, rather massive, stout, densely covered with linear-lanceolate, brown, hair-tipped scales; Stipes up to 30 x 0.5 cm, slender, erect, rather stout, glabrous, shining, articulate to rhizome; lamina up to 70 - 140 x 25 - 35 cm, deltoid to obovate-lanceolate, simple pinnate; lateral pinnae numerous, up to 25 pairs, sessile, opposite or subopposite; upper pinnae gradually reduced with a very small single terminal one; the lowest

pair somewhat reduced; largest pinnae up to 10 - 20 x 0.5 - 1 cm, linear or linear-lanceolate, sessile, cordate to auricled at base, horizontally placed, graduálly tapering into a lanceolate acuminate apex, margin crenate or serrate; texture subcoriaceous, dark-greenish when dry, glabrous on both surfaces veins prominemt, a series of areoles with included veinlets, free towards margin. Sori up to 0.1 cm wide, small, globose, terminal on included veinlets within the areoles; deeply sunk, sporangia shortly stalked; spores small, hyaline.

Very rare, on moist, rather open moss-covered tree trunks, associated with Pseudodrynaria coronans.

Fertile: July.

Distribution: Nagaland.

Specimens examined: Jamir 7117 Changki Village (Mokokchung dist., 1000 m) (It is proposed to deposit the Holotype in CAL after the valid publication of this taxon).

This variety is quite distinct from the true P. argutum in the shape and size of leaves, and the nature of veins. Probably forms a distinct species.

Polypodium lachnopus Wall. ex Hook. Icon. Pl. t. 952.1854; Mett. Farngatt. Polypod. 75. 1857; Hook., Sp. Fil. 5: 25. 1867; Clarke, in Trans. Linn. Soc. Ser. 2(Bot.) 1: 551. 1880; Dhir, Ferns. N.W. Himalayas 121. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 71.1982. Goniophlebium lachnopus J. Smith in Hook. Gen. ad., t. 15. 1840; Bedd., Handb. Ferns Brit. India 319. 1883.

Epiphytes. Rhizome up to 0.5 cm across, rather wide-creeping, wiry, densely covered with linear, blackish-brown, spreading hair-tipped scales; scales about 0.7 cm long. Stipes 5 - 15 cm long, slender, erect, pale-brown, articulate to rhizome, sparsely scaly, scales similar to rhizome scales; lamina 15 - 40 x 3.5 - 8 cm, simply pinnatifid; pinnae numerous, deeply cut down very near to the rachis, alternate, decurrent at base; the lowest pair somewhat reduced to above and cut down very near to the rachis, terminal with a single lanceolate, acuminate lobe; largest pinnae up to 5 x 1 cm, linear-lanceolate, broadest at base, gradually tapering into obtuse or acute apex, margin serrulate or crenate; texture thin, membranous; dorsal surface of rachis covered with white tomentum, ventral surface covered with hair-like, small scales, veins visible, minute, with free veinlets. Sori small, round, in two rows, one on either side of costule in each segment; sporangia slender, stalked; spores oval, yellowish-brown, hyaline.

Common, on moist mossy tree trunks; often on humus covered rocks. There is very little difference between this species and

the next species as indicated in the key. However we feel that these two species fomm one and the same species. But Biosystematic studies can only decide on this.

Fertile: July - October.

Distribution: INDIA - Himalaya, Kashmir at 600 - 900 m elevation, very common ; Meghalaya at 900 - 1500 m elevation.

Specimens examined: Jamir 6122, 7128 Kohima (Kohima dist., 1445 m); 6516 Wokha (Wokha dist., 1314 m); 6227 Changki (Mokokchung dist., 1000 m).

Polypodium microrhizoma Clarke ex Baker in Hook. et Baker Syn. Fil. ed. 2. 511. 1874; Clarke in Trans. Linn. Soc. ser. 2 (Bot.) 1: 551. 1880; Dhir, Ferns N.W. Himalayas 121. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 71. 1982.

Goniophlebium microrhizoma (Clarke ex Baker) Bedd., Handb. Ferns Brit. India 322. 1883.

Epiphytes. Rhizome up to 0.3 cm wide, rather wide-creeping, wiry, densely covered with blackish-brown, spreading, ovate to lanceolate, scales; scales about 0.5 cm long; margin of of scales hooked at the tip. Stipes up to 15 cm long, sparsely scaly, pale-brown, articulate to rhizome; lamina 15 - 30 x 5 - 10 cm, oblanceolate, sub-unipinnate to pinnate; pinnae numerous, deeply cut down very near to the rachis; alternate

decurrent at base; usually the lowest pair of pinnae somewhat reduced above and cut down very near to the rachis; largest pinna 3 x 0.5 cm, lanceolate, broadest at base, obtuse or rarely acute at apex, margin finely incised or serrate; texture herbaceous; rachis glabrous above, castaneous beneath; veins obscure, forming a series of areoles on costal region, or all the veins often quite free, and not forming areoles. Sori superficial,, at the upper half of the pinnae; sporangia oval, with short-stalks; spores round to reniform, hyaline; exine verrucous.

Common on moist tree trunks as well as on moss covered wet rocks near water courses in forests.

Fertile: July - October.

Distribution: BHUTAN, INDIA - N.W. Himalaya, Kashmir at 1500 - 2400 m elevation, Meghalaya at 1900 m elevation.

Specimens examined: Jamir 6227 Changki (Mokokchung dist., 1000 m); 6539 Wokha (Wokha dist., 1314 m); 7128 Kohima (Kohima dist., 1445 m).

2. Neocheiropteris

C. Chr., in Bull. Soc. Bot. France 52 Mem. 1: 21. 1905; et Ind. Fil. 432. 1906; Copel.,Gen. Fil. 188. 1947.

Terrestrials. Rhizome scandent, rather stout; covered with clathrate scales. Stipes rather short, articulate to rhizome,

sparsely scaly; lamina simple or pedatisect; paleate; veins reticulate, with branched, included veinlets. Sori globose, large, closely, biseriate, dorsal, superficial, along anastomosing veinlets; paraphyses peltate, or laterally fixed, clathrate, toothed; sporangia slender stalked, annulus about 10 - 16-celled; spores bilateral.

A genus of about 10 species; 1 in Nagaland.

Neocheiropteris normalis (D.Don) Tagawa in J. Jap. Bot. 27: 217. 1952; Baishya & Rao, Ferns & Fern-allies Meghalaya 68. 1982.

Polypodium normale D. Don, Prodr. Fl. Nepal 1. 1825; Clarke, in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 558. 1880.

Pleopeltis normalis (D.Don) Bedd., Handb. Ferns Brit. India 353. 1883.

Microsorium normale (D.Don) Ching, in Bull. Fan. Mem. Inst. Biol. Bot. 4: 299. 1933; Holttum, Fl. Malaya 2: 176. 1954.

(Plate 30)

Rhizome up to 0.5 cm wide; scandent, somewhat flattened, covered with small, clathrate, adpressed, entire, ovate-lanceolate scales with a tuft of stiff, red-brown hairs on the upper surface at the point of attachment of the peltate base. Stipes 2 - 6 cm long, sparsely covered with adpressed, brown scales, articulate to rhizome; fronds on rhizome 1 - 2 cm apart; lamina 25 - 50 x 2 - 5 cm, simple, narrowed gradually at both ends, broadest in middle, margin usually entire, often

slightly wavy, texture thin, submembranous, glabrous, greenish-brown when dry; veins not prominent, lateral veins inconspicuous, larger veins distinct in dried fronds, forming irregular areoles. Sori up to 0.3 cm across, rather large, globose, in one irregular row on either side of the midrib (or sometimes 2 - 4 irregular rows) superficial or little immersed; sporangia oval, shortly slender stalked; spores oval to reniform, light-yellow, hyaline; exine verrucoid.

Frequent, on tree trunks in dense evergreen forests, often grows on ground.

Fertile: July - December.

Distribution: MALAYA, BHUTAN, CHINA, SUMATRA, NEPAL, INDIA-Himalayas, Meghalaya at 900 - 1500 m elevation.

Specimens examined: Jamir 6162 Pfutsero (Phek dist., 2134 m); 6526 Wokha (Wokha dist., 1314 m); 6428 Zenheboto (Zenheboto dist., 1875 m).

3. Lepisorus

(J. Smith) Ching, in Bull. Fan. Mem. Inst. Biol. Bot. 4: 56. 1933; Copel., Gen. Fil. 182. 1947.

Epiphytes. Rhizome creeping; scales clathrate. Stipes short, articulate to rhizome. Fronds simple, linear, lanceolate to elliptic, glabrous or scaly; usually fleshy or coriaceous, often herbaceous; margin entire; veins usually hidden, with

free included, forked veinlets, ending in hydathodes. Sori round or oval, large to small, borne in a single row on either side of costa; paraphyses peltate, clathrate, annulus incomplete; spores bilateral.

A genus of 25 species; 15 in Nagaland.

KEY TO SPECIES

1a. Rhizome more than 0.5 cm across.

2a. Rhizome scales concolororous; lamina large, isodiametric.

3a. Fronds coriaceous; venation obscure; sori nearer to the midrib . . . . oligolepidus

3b. Fronds chartaceous; or subcoriaceous; venation visible; sori medial . . . . . clathratus

2b. Rhizome scales discolorous; lamina various.

4a. Lamina broadly ovate-lanceolate, chartaceous; soir not sunken, verrucose . . . . . sublinearis

4b. Lamina lanceolate or narrowly ovate-lanceolate, papyraceous, membranous or subcoriaceous; sori sunken; spores tuberculate or verrucose or smooth.

5a. Lamina subcoriaceous, broad-lanceolate, 3- 4 cm wide . . . oosphaerus

5b. Lamina lanceolate or narrowly ovate-lanceolate, less than 2.5 cm wide, subcoriaceous or not; rhizome scales erose or serrate, dentate.

6a. Veins distinct; rhizome scales hair-pointed . . . . . excavatus

6b. Veins indistinct; rhizome scales otherwise.

7a. Lamina linear; apex tapering; spores tuberculate . . . . . ussuriensis

7b. Lamina lanceolate, obtuse at apex; spores smooth . . . . . nudus

1b. Rhizome less than 0.5 cm across.

8a. Rhizome scales distinctly peltate . . . contortus

8b. Rhizome scales not peltate or slightly peltate.

9a. Lamina of scales all clear; sori round, subcostal; lamina 2-3 cm broad.

10a. Scales white margined . . . . . kashyapii

10b. Scales not white margined . . . . morrisonensis

9b. Lamina of central cells more or less opaque and marginal cells clear; sori medial or submedial; lamina less than 3 cm broad.

11a. Rhizome scales concolorous; sparingly toothed . . . . . sordidus

11b. Rhizome scales bicolorous; distinctly toothed.

12a. Lamina 0.4 - 0.8 cm across; sori submedial, confluent towards the apex of lamina . . . . . subconfluens

12b. Lamina 0.5 - 2 cm wide; sori medial, not confluent.

13a. Sori 0.1 - 0.2 cm wide . . . . thunbergianus

13b. Sori 0.3 - 0.4 cm wide . . . amaurolepidus

Lepisorus amaurolepidus (Sledge) Bir & Trikha in Bir & Vasudeva in J. Bomb. Nat. Hist. Soc. 68: 192. 1971 var. amaurolepidus Bir & Trikha in Amer. Fern. Journ. 64: 60. 1974; Baishya & Rao, Ferns & Fern-allies Meghalaya 68. 1982.

Pleopeltis amaurolepida Sledge in Bull. Brit. Mis. Nat. Hist. 2 (5): 136. 1960.

Polypodium gladiatum Wall. Nam. List. no. 279. 1828 nom. non. P. gladiatum Kunze, 1834.

Rhizome 1.5 - 3 cm across, long-creeping, branched, densely covered with dark-brown, peltate, clathrate scales; scales ovate-lanceolate, broad at base, margin dentate, up to 0.5 x 0.1 cm, Stipes 0.5 - 3.5 cm long, glabrous, articulate to rhizome; lamina 8 - 30 x 1 - 2 cm, linear-lanceolate, gradually

decurrent on stipe, narrowly long-acuminate or rarely abruptly shortened to an acute apex, margin entire; texture coriaceous; light-green to brownish when dry, fleshy, both surfaces of lamina glabrous, except for a few scales beneath the midrib; veins visible, forming 2 or 3 series of areolae in between the midrib and the margin; sori 0.2 - 0.4 cm wide, rather large, globose, golden-brown, medial; sporangial paraphyses with thickened and coloured cell walls; glandular cells absent when young; annulus of 10 - 14 thickened cells; spores reniform, yellow; exine thick, smooth.

Abundant, on open tree trunks, sometimes covering the whole length of tree trunks.

Fertile: July - October.

Distribution: SRI LANKA, INDIA - South India, Central India, Himalayas and Meghalaya.

Specimens examined: Jamir 6151 Pfutsero (Phek dist., 2136 m); 6385 Mezenkong forests (Mokokchung dist., 1445 m).

Lepisorus clathratus (Clarke) Ching in Bull. Fan. Mem. Inst. Biol. 4: 71. 1933; Mehra & Bir in Res. Bull. Panjab Univ. (N.S.) 15, 169. 1964; Dhir, Ferns N.W. Himalayas 125. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 64. 1982.

Polypodium clathratum Clarke in Trans. Linn. Soc. Lond. ser. 2 (Bot.) 1: 539. 1880.

Pleopeltis clathrata (Clarke) Bedd., Handb. Ferns Brit.

India 348. 1883.

Epiphytes. Rhizome up to 0.5 cm long, wide-creeping, covered with blackish-brown, clathrate, concolorous, deciduous scales; scales ovate-lanceolate, margins toothed; lamina all clear. Stipes up to 4 cm or more long, deciduous, lamina 15 - 35 x 1 - 3 cm, linear or elliptical to lanceolate, attenuate at base, broadest somewhat below the middle, gradually tapering to an acute or obtuse apex; texture subcoriaceous, brownish when dry, glabrous above, and with a few sparse brown, peltate, ovate scales on the lower surface; veins visible on both surfaces, much anastomosing, but not prominent towards the edge of the lamina. Sori large, round, medial, occupying upper half of the lamina; annulus of 8 - 12 cells; spores elliptical, exine papillate.

Frequent, on tree trunks; often as lithophytic.

Fertile: October - November.

Distribution: AFGHANISTAN, NEPAL, CHINA, SIBERIA, JAPAN, TAIWAN, INDIA - N. India, N.W. Himalayas, Kashmir at 3000 - 3800 m elevation, and Meghalaya.

Specimens examined: Jamir 6306 Shamator (Tuensang dist., 1692 m); 7171 Helipong forests (Tuensang dist., 1372 m).

Lepisorus contortus (C.Chr.) Ching in Bull. Fan. Mem. Inst. Biol. 4: 90. 1933; Bir & Trikha in Bull. bot. Surv. India 11: 271. 1969; Dhir in Ferns N. W. Himalayas 124. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 64. 1982.

Polypodium contortum C. Chr., in Bot. Gez. 51: 347. 1911.

Pleopeltis contorta (C.Chr.) Alston & Bonner in Candollea 15: 109. 1956.

Rhizome up to 0.2 cm wide, creeping, dark-brown, covered with ovate-lanceolate, ferruginous scales along with moniliform hairs. Stipes 1 - 3 cm long, purplish-brown, glabrous, articulate to rhizome, lamina 10 - 20 x 0.5 - 1.5 cm, linear, narrowly attenuate towards the apex, margin entire; texture coriaceous, brownish when dry, glabrous above, lower surface sparsely covered with pale-brown, peltate scales; veins not visible. Sori about 0.3 cm across, rather large, medial, oblong or globose, sometimes confluent, occupying the upper half of the lamina, sporangia slender stalked; annulus of 10 - 14 cells; spores reniform, yellow, hyaline, exine muricate.

Abundant on tree trunks, usually in exposed forests.

Fertile: July - August.

Distribution: INDIA - N.W. Himalayas, Meghalaya.

Specimens examined: Jamir 6233 Changki (Mokokchung dist., 1000 m); 6147 Phek (Phek dist. 1200 m).

Lepisorus excavatus (Bory) Ching in Bull. Fan. Mem. Inst. Bio. 4: 68. 1933; Bir & Tirkha in Bull. bot. Surv. India 11: 273. (1969); et in Amer. Fern. J. 64: 58. 1974; Baishya & Rao, Ferns & Fern-allies Meghalaya 64. 1982.

Polypodium excavatum Bory in Willd., Sp. Pl. 5: 158. 1810.

Pleopeltis simplex Bedd., Handb. Ferns Brit. India 347. 1883.

P. excavatus (Bory) Sledge in Bull. Brit. Us. Nat. Hist. 2(5): 138. 1960.

(Plate 31)

Rhizome 0.3 - 0.7 cm wide, rather stout, compressed, densely covered with pale-brown scales; scales clathrate with a slightly erose margin, narrowly lanceolate, acuminate, about 0.2 - 0.7 cm long. Stipes 0.5 - 2.5 cm long, pale-btown to yellowish-brown, articulate to rhizome, glabrous or slightly stramineous; lamina 10 - 50 x 1.5 - 3 cm, ovate-lanceolate, gradually decurrent at the stipe, narrowly lanceolate-acute at apex; margin entire, broadest somewhat below the middle; texture thin, membranous, pale-brown to greenish when dry; sparsely small scaly on the lower surface along the costa; scales yellowish-brown, thickened in the centre, deciduous; veins prominent. Sori 0.2 - 0.5 cm wide, closer to the midrib than to the margin, deeply sunk, forming pustules on the dorsal surface of the lamina; sporangia shortly stalked; paraphyses thick in the centre; spores light-brown, more or less tuberculate, oval to reniform.

common on moist, shady tree trunks.

Fertile: July - October.

Distribution: JAPAN, TROPICAL AFRICA, MADAGASCAR, INDIA-South India, Himalayas at 1500 - 2100 m elevation, Darjeeling

Specimens examined: Jamir 6112 Kohima (Kohima dist., 1445 m); 6145 Phek (Phek dist., 1200 m).

Lepisorus kashyapii (Mehra) Bir in Res. Panjab. Univ. (N.S.) 13, 24, 1962; Dhir, Ferns N.W. Himalayas 123. 1980.

Polypodium kashyapii Mehra, Ferns Muss. 24. 1939.

Pleopeltis kashyapii (Mehra) Alston & Bonner, Candollea 15: 208. 1956.

(Plate 32)

Epiphytes. Rhizome up to 0.5 cm wide, wide-creeping, densely covered with pale-brown, ovate-lanceolate, acuminate, 0.5 x 0.1 cm scales. Stipes 0.5 - 1 cm long, glabrous, often scaly, articulate to rhizome; lamina 20 - 30 x 2.5 - 3.5 cm, ovate-lanceolate, gradually tapering towards base, broadest below the middle, margin entire; texture subcoriaceous, dark-brown when dry, sparsely scaly, veins prominent. Sori up to 0.3 cm across, globose, often oblong, in a single row on either side of the midrib, occupying the upper half of lamina; sporangia shortly stalked; spores pale-brown, tuberculate.

Rare; on moist, shady tree trunks in forests.

Fertile: July - August.

Distribution: N.W. Himalayas at 1,500 - 2,700 m elevation, Meghalaya. Evidently a new distributional record for northeast India.

Specimens examined: Jamir 6150 Phek (Phek dist., 1200 m);

Lepisorus loriformis (Wall. ex Mett.) Ching in Bull. Fan. Mem. Inst. Biol. 4: 81. 1933; Bir & Tirkha in Bull. Bot. Surv. India 11: 262. 1969; Dhir, Ferns N.W. Himalayas 125. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 65. 1982.

Polypodium loriforme Wall. ex Mett. Farngatt. Polypod. 1: 92. 1857.

Pleopeltis loriformis (Wall. ex Mett.) Moore Ind. Fil. 346. 1862; Bedd., Handb. Ferns Brit. India 346. 1883. (Pro parte).

Polypodium lineare var. stensite Clarke, in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 559. 1880.

Epiphytes. Rhizome up to 0.2 cm across, creeping, densely covered with blackish-brown, ovate-lanceolate, clathrate, ferruginous, hair-tipped scales; scales about 0.5 x 0.1 cm; margin with small projection; roots fibrous, dark. Stipes 0.2 - 2 cm long, glabrous, articulate to rhizome; lamina 12 - 25 x 0.2 - 1 cm, linear, narrowly decurrent towards base,

gradually tapering into a long acuminate apex, margin entire or undulate; texture subcoriaceous, brown when dry, glabrous above and sparsely clothed with brown, peltate scales on the lower surface, midrib prominently raised; veins obscure. Sori up to 0.3 cm across, globose or oblong, rather large, submarginal, sometimes projecting beyond the margin; sporangia pale-brown; annulus of 10 - 13 cells; spores oval, light-yellow; exine papillate.

Not common, sometimes grows on moss covered rocks.

Fertile: September - October.

Distribution: INDIA - N.W. Himalayas, Meghalaya.

Specimens examined: Jamir 6367 Morong forest (Tuensang dist., 2136 m).

Lepisorus morrisonensis (Hayata) H.Ito in J. Jap. Bot. 11: 91. 1935; Tagawa in Acta Phytotax. Geobot. 7: 189. 1938, 11: 307. 1942; DeVol, & Kuo, Fl. Taiwan (ed.2). 1: 187. 1980.

Polypodium morrisonense Hayata in Bot Mag. Tokyo 23: 77. 1909; Icon. P. Form. 5: 321. t. 133. 1915.

Lepisorus bicolor (Tekeda) Ching, in Bull. Fan. Mem. Inst. Biol. 4: 66. 1933; Icon. Fil. Sin. 2: Pl. 65. 1935.

Polypodium excavatum (Bory) Ching var. bicolor Takeda in Notes Roy. Bot. Gard. Edinb. 8: 279. 1915; C. Chr. in Contr. U.S. Nat. Herb. 26: 319. 1931.

Epiphytes. Rhizome up to 0.5 cm across, creeping, dorsiventral, the apical part covered with discolorous, broadly ovate-lanceolate, clathrate, imbricating scales; scales about 0.5 x 0.1 cm, margin entire or somewhat irregular; Stipes 0.5 - 1.5 cm long, stramineous, articulate to rhizome, lamina 20 - 30 x 1.5 - 3 cm, linear, elliptic, slightly attenuate at base, margin entire or rather serrulate; texture thin, herbaceous, brownish-when dry, both surfaces of lamina glabrous except for a very few ovate, clathrate scales along the costa on the lower surface; midrib prominently raised; veins depressed, obscure. Sori about 0.5 cm across, globose, often oblong, superficial, nearer to costa than margin, occupying upper half of the lamina; sporangia bearing 2-celled, hair-like paraphyses; spores oval, dark-brown; exine finely spinulose.

Frequent, on moist free trunks.

Fertile: December.

Distribution: CHINA, TAIWAN, INDIA - N.W. Himalayas, Meghalaya.

Specimens examined: Jamir 7944 Zenheboto (Zenheboto dist., 2053 m).

Lepisorus nudus (Hook.) Ching in Bull. Fan. Mem. Inst. Biol. 4: 83. 1933; Mehra & Bir in Res. Bull. Panjab. Univ. (N.S.) 15: 169. 1964; Dhir, Ferns N.W. Hiamalaya 124. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 65. 1982.

Pleopeltis nuda Hook. Exot. Fl. 1, t. 63. 1823.

Pleopeltis linearis sensu Bedd., Handb. Ferns Brit. India 346. 1833 (pro parte) (non Polypodium lineare Thunb., 1784).

Polypodium wightiana (Thw.)Bedd., Ferns South India 60, t. 180. 1863.

Polypodium lineare sensu Clarke in Trans. Linn. Soc. Lond. Ser. 2 (Bot.) 1: 558. 1880 (Pro parte).

Epiphytes. Rhizome up to 0.5 cm across, wide-creeping, rather stout, densely covered with concolorous, pale-brown, ferruginous, ovate-lanceolate, acuminate scales; scales about 0.6 x 0.2 cm, Stipes 0.3 - 3 cm long, usually glabrous, rarely scaly, articulate to rhizome; lamina 15 - 25 x 1 - 3 cm, narrowly tapering at base, broadest below the middle, margin entire; texture coriaceous, pale-greenish, both surfaces of lamina glabrous or often scaly beneath along the midrib; veins not prominent; areole irregular with forked, free veinlets. Sori in a single row on wither side of the costa and occupying upper half of the lamina, small, medial, superficial or slightly immersed; annulus of 10 - 14 cells; spores oval to round, light-yellow, vacuolated; exine smooth.

Rather common, on moist tree trunks in shades.

Fertile: August - October.

Distribution: SRI LANKA, MALAYA, CHINA, JAPAN, AFRICA, INDIA - Throughout South India, Himalayas up to 300 - 3500 m elevation, Meghalaya.

Specimens examined : Jamir 6317 Morong forests (Tuensang dist., 2136 m); 6581 Shamator village (Tuensang dist., 1692 m).

This species is quite similar to L. thunbergianus Ching, with which it is often confused. In case of L. nudus the rhizome scales are ovate, acute, entire and brownish; while those of L. thunbergianus Ching are subulate-lanceolate, long acuminate, ciliate-dentate and black.

Lepisorus oligolepidus (Baker) Ching, in Bull. Fan. Mem. Inst. Biol. 4: 80. 1933; Bir & Tirkha in Amer. Fern. J. 64: 50. 1974.

Polypodium oligolepidum Baker, Gard. Chron. n.s. 74: 494. 1880.

Polypodium lineare var. oligolepidum (Baker) C.Chr., in Bull. Soc. Bot. France 52: Mem. 1: 15. 1905.

Rhizome 0.2 - 0.5 cm wide, rather stout, densely covered with rigid, narrowly ovate-lanceolate to subulate, dark-brown to opaque scales; scales 0.6 x 0.1 cm. Stipes 1 - 4 cm long, rather stout, dark-stramineous; articulate to rhizome; lamina

15 - 25 x 1.5 - 2.5 cm, slightly decurrent on stipe, gradually acuminate at apex, margin entire; texture coriaceous, blackish-green when dry; the upper surface glabrous, often punctate, the lower surface covered with deciduous, blackish, ovate-lanceolate, long-acuminate scales; veins hidden. Sori 0.2 - 0.4 cm across, round, medial or closer to the midrib; sporangial paraphyses circular, reddish to brownish-black, thicker in the centre, hair-like with a glandular apical cell; annulus of 12 - 16 thickened cells; spores light or yellow, tuberculate, granulate, oval or plano-convex.

Frequent, in dense moist evergreen forests.

Fertile: October.

Distribution: BURMA, CHINA, JAPAN, INDIA - Himalayas (This species is very rare in India, collected only once in Mussorie).

Specimens examined: Jamir 6352 Morong forest (Tuensang dist., 2136 m); 7172 Helipong forests (Tuensang dist., 1372 m).

A new record for northeast India.

Lepisorus oosphaerus (C.Chr.) Ching in Bull. Fan. Mem. Inst. Biol. 4: 70. 1933; Bir & Tierkha in Amer. Fern J. 64: 58. 1974.

Polypodium oosphaerum C. Chr., Contr. U.S. Nat. Herb. 26: 334. Pl. 29. 1931.

Pleopeltis oosphaera (C.Chr.) Panigrahi & Patnaik in Proc. Nat. Acad. Sci. India B, 34: 482. 1964.

Rhizome up to 0.5 cm across, long creeping, scaly; scales concolorous, the margin erose, narrowly-lanceolate, acuminate, up to 0.5 cm long; roots wiry. Stipes up to 0.5 cm long, glabrous, articulate, to rhizome; lamina 25 - 40 x 2.5 -3.5 cm, broadly lanceolate, abruptly narrowed and decurrent towards the base, broadest below the middle, acute at apex, yellowish-brown when dry, texture subcoriaceous; midrib prominently raised, veins conspicuous on the dorsal surface, the lateral midveins not prominent, up to 6 areolae between the margin and the midrib. Sori oblong, medial, slightly punctate on the upper surface, often confluent; sporangial paraphyses peltate, clathrate; annulus of 10 - 15 thickened cells; spores pale-yellow to hyaline; tuberculate, oval to elliptic.

Frequent; on moist tree trunks in open places.

Fertile: December.

Distribution: NORTHERN THAILAND, INDIA - Eastern Himalayas and northeast India.

Specimens examined: Jamir 6458 Zenheboto (Zenheboto dist., 1875 m).

Lepisorus sordidus (C.Chr.) Ching, Bull. Fan. Mem. Inst. Biol. 4: 78. 1933.

Polypodium sordidum C. Chr., Contr. U.S. Nat. Herb. 26: 320. 1931.

Pleopeltis sordida (C.Chr.) Panigrahi & Patnaik in Curr. Sci. 34: 127. 1965.

(Plate 33)

Epiphytes. Rhizome up to 0.3 cm across, rather short-creeping, hypogeous, blackish, apical part covered with blackish-brown to black, entirely opaque, rigid, concolorous, sparingly toothed, lanceolate-acuminate scales; scales about 0.3 cm long; roots fibrous. Stipes 3 - 8 cm or more long, pale-brown to dark-stramineous, sulcate above, glabrous; lamina 18 - 40 x 1.5 - 3 cm or more, lanceolate, cuneate and short, decurrent at base, broadest below the middle, acuminate at apex, greyish-green to yellowish; texture coriaceous both surfaces glabrous, except for a few deciduous, black, ovate scales along the midrib; veins hidden. Sori 0.3 - 0.4 cm across, superficial, globose, submarginal, uniseriate, usually borne on the upper half of the lamina; sporangial paraphyses black, clathrate, stellate, filiform; annulus of 10 - 16 thickened cells; spores hyaline to pale yellow; granulate, globose, to elliptic.

Frequent; on tree trunks in dense evergreen forests.

Fertile: October.

Distribution: BURMA, YUNNAN, CHINA, INDIA - Eastern Himalayas, Arunachal Pradesh at 1600 m elevation.

Specimens examined: Jamir 6339 Morong forests (Tuensang dist.m 2136 m); 6424 Khensa Village (Mokokchung dist., 1329 m).

Lepisorus subconfluens Ching, Bull. Fan. Mem. Inst. Biol. 4: 83. 1933; Bir & Tirkha, Amer. Fern J. 64: 60. 1974.
Polypodium neurodioides C. Chr., Contr. U.S. Nat. Herb. 26: 319. 1931 nom. illeg.
Pleopeltis subconfluens (Ching) Panigrahi & Patnaik in Curr. Sci. 34: 127. 1965.

Rhizome about 0.2 cm wide, creeping, densely scaly; scales linear, blackish-brown, margin slightly hyaline and dentate, 0.1 - 0.3 cm long. Stipes 0.5 - 1 cm long, terete, articulate to rhizome; lamina 7 - 20 x 0.2 - 0.8 cm, linear-elongate, narrowly tapering towards stipe, broadest somewhat in middle, acuminate at the apex, margin entire or rather narrowly revolute, glabrous; texture coriaceous, light green to brownish-when dry; veins obscure. Sori small, globose or oval, often elongate oblong, submedial, usually in a single row on each side of the costa (more or less in the upper half of the lamina); sporangia shortly stalked, paraphyses clathrate with an erose margin; annulus of 10 - 15 thickened cells; spores round to oval, sometimes elliptical, pale-yellow; exine reticulate, granulate.

Rather common; on moist moss-covered tree trunks in evergreen forests.

Fertile: October.

Distribution: THAILAND, YUNNAN, CHINA, INDIA - Eastern Himalayas, Arunachal Pradesh, Meghalaya, Assam.

Specimens examined: Jamir 6384 Mezenkong forests (Mokokchung dist., 1326 m); 6319 Morong forests (Tuensang dist., 2136 m).

Lepisorus sublinearis (Baker) Ching, Bull. Fan. Mem. Inst. Biol. 4: 78. 1933; Bir & Tirkha Amer. Fern. J. 64: 52. 1974.
Polypodium sublineare Baker ex Takeda, Notes Roy. Bot. Gard. Edinb. 8: 276. 1915.

Rhizome about 0.4 cm across, creeping, densely covered with ovate-lanceolate, dark-brown, fuscous, coarsely clathrate scales; scales rather stout, margin short with protruding teeth, about 0.2 - 0.5 x 0.1 - 0.2 cm. Stipes 4 - 8 cm long, stramineous, dark-brown when dry; veins obscure; Sori round, medial, in the apical 1/2 - 1/3 of the lamina; sporangial paraphyses stellate to umbellate; annulus of 10 - 16 thickened cells; spores yellow, verrucose, oval to round.

Not common; collected only once on tree trunks in open places.

Fertile: July- September.

Distribution: BURMA, CHINA, INDIA - Eastern Himalayas, Assam and Manipur at 1200 - 1800 m elevation.

Specimens examined: Jamir 6066 Peren (Kohima dist., 1446 m).

Lepisorus thunbergianus (Kaulf.) Ching, in Bull. Fan. Mem. Inst. Biol. 4: 88. 1933; et in Icon. Fil. Sin. 2, 76. 1934; Dhir, Ferns N.W. Himalayas 124. 1980.

Pleopeltis thunbergiana Kaulf., Wess. d. Franskr. 113. 1827.

Pleopeltis linearis (Thunb.) Bedd., Handb. 346. Pl. 194. 1883.

Polypodium linearis Thunb., Fl. Jap. 335. 1784.

Epiphytes. Rhizome 0.1 - 0.3 cm wide, wide-creeping, covered with discolorous, broad-based, brown, peltate, clathrate, dark-brown to black, opaque, acuminate scales; scales about 0.2 cm long. Stipes 1 - 3.5 cm long, slender, glabrous or rarely with few scales, articulate to rhizome; lamina 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; texture coriaceous; dark-brown when dry, both surfaces glabrous; midrib prominently raised; veins obscure. Sori round to oval, close spaced, medial, in a single row on either side of the costa; paraphyses round, peltate, centre dark, margin pale.

Frequent, on moist shady tree trunks, sometimes grows as lithophytes.

Fertile: July - November.

Distribution: CHINA, JAPAN, TAIWAN, PHILIPPENES; INDIA - North-Western Himalayas, at 1800 - 2100 m elevation.

Specimens examined: Jamir 7084 Kohima (Kohima dist., 1445 m); 6065 Peren (Kohima dist.m 1446 m).

This species is remarkably distinguishable from L. nudus in having subulate-lanceolate, long acuminate apex, ciliate-dentate and black rhizome scales.

Lepisorus ussuriensis (Regal et Maack) Ching in Bull. Fan. Mem. Inst. Biol. 4: 91. 1933; Bir & Tirkha in Bull. bot. Surv. India 11: 268. 1969; Baishya & Rao, Ferns & Fern-allies Meghalaya 65, 1982.

Pleopeltis ussuriensis Regel et Maack. in Mem. Acad. Sci. Petersle 7: 40, 175. 1861.

Polypodium lineare var. ussuriensis C. Chr., Ind. Fil. 572. 1906.

(Plate 34)

Epiphytes. Rhizome short-creeping, wiry, more or less covered with blackish-brown, lanceolate acuminate scales; scales about 0.2 cm long, cells thick-walled; roots fibrous, blackish. Stipes up to 1 cm long, articulate to rhizome. Fronds 4 - 15 x 0.3 - 0.8 cm, linear-elongate, narrowly decurrent towards base, broadest in the middle, gradually tapering to a lanceolate, acuminate apex, margin entire, texture subcoriaceous, pale green when dry, usually glabrous on both surfaces of lamina; midrib distinct; veins indistinct. Sori small, depressed, medial, usually occupying the upper half of the fronds; sporangia light-brown; annulus of 10 - 13 cells; spores oval to elliptic, yellow; exine tuberculate.

Extremely rare, on moist shady and moss-covered tree trunks in forests.

Fertile: October.

Distribution: INDIA - N.W. Himalayas, Meghalaya.

Specimens examined: Jamir 6545 Wokha (Wokha dist., 1314 m).

4. Lepidogrammitis

Ching, Sunyatsenia 5: 258. 1940.

Usually epiphytic, sometimes grow as lithophytic. Rhizome long-creeping; scales clathrate. Fronds monomorphic; veins hidden. Sori round, distinct, covered with paraphyses and clathrate, peltate scales.

This genus shares the characters of both Lemmaphyllum and Lepisorus.

A genus of 10 - 12 species; 1 in Nagaland.

Lepidogrammitis rostrata (Hook.) Ching in Acta Phytotax. Sin. 9: 372. 1964; DeVol & Kuo in Fl. Taiwan 1: 183. 1980.

Polypodium rostratum Hook., Icon. Pl. t. 953. 1854, Cont. Ferns t. 53. 1854,

Pleopeltis rostrata Bedd., Ferns Brit. India t. 159. 1867; et Handb. Ferns Brit. India 245. f. 193. 1892.

Lemmaphyllum subrostratum (C.Chr.) Ching, in Bull. Fan.

Mem. Inst. Biol. 4: 97. 1933.

Lepisorus megasorus sensu H.Ito in J. Jap. Bot. 11: 92. 1935.

(Plate 34A).

Epiphytes as well as lithophytes. Rhizome 1 - 1.5 cm wide; widely creeping, more or less densely covered with clathrate, concolorous, brown, broad based scales; scales narrowly linear, lanceolate, margins denticulate, about 0.4 x 0.1 cm. Stipes 1 - 3.5 cm long, 1.5 - 2.5 cm apart, glabrous, articulate to rhizome; lamina 6 - 12 x 1 - 3 cm, lanceolate, or alternate, at base, apex acuminate, margin entire; texture coriaceous, glabrous on both surfaces; midrib distinct; veins hidden, reticulate, areoles irregular, including simple or forked, free veinlets. Sori up to 0.5 cm across, large, glabrous, round, in a single row on either side close to the midrib, covered with clathrate, peltate scales when young.

Common on tree trunks, in moist, dense evergreen forests.

Fertile: July - December.

Distribution: BURMA, VIETNAM, CHINA, TAIWAN, BHUTAN, INDIA Himalayas, Sikkim at 1829 m elevation; Meghalaya at 1220 - 1525 m elevation.

Specimens examined: Jamir 7921 Kohima (Kohima dist., 1445 m); 6152 Pfutsero (Phek dist., 2134 m); 6356 Morong forests (Tuensang dist., 2136 m).

5. Lemmaphyllum

Presl. Epim. Bot. 157. 1849; Copel. Gen. Fil. 189. 1947.

Slender epiphytes. Rhizome wide creeping; scales ovate-lanceolate to acicular, based wide with short arms. Fronds dimorphic, articulate to rhizome, pale-greenish, margin entire. Stipes distant, texture somewhat fleshy, veins hidden or hardly visible, reticulate with free, included veinlets running towards costa. Sori usually linear, continuous on either side of costa, often covering the whole undersurface when mature; paraphyses peltate, clathrate, hooked; annulus 10 - 14 celled; spores bilateral.

A genus of 10 - 12 species; 1 in Nagaland.

Lemmaphyllum carnosum (Wall.) Presl, Epim. Bot. 158. 1849; Baishya & Rao, Ferns & Fern-allies Meghalaya 62. 1982.
Notholaena carnosa Wall,, Cat. 138. 1828 (nom. nud.).
Drymoglossum carnosum (Wall.) J.Smith in Hook. Gen. Fil. t. 78 A. 1841; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 575. 1880; Bedd., Handb. Ferns Brit. India 411, t. 243. 1883.
Lemmaphyllum microphyllum Presl. Epim. Bot. 263. 1849; DeVol & Kuo, Fl. Taiwan 1: 181. 1980.

Rhizome slender, wide-creeping, rather wiry, more or less densely covered with scales; scales peltate, clathrate, linear-lanceolate, acicular with broad, forked bases, margin

ciliate, basal cells honey-comb-like, dark-brown, narrowly hair-tipped, about 0.2 cm long. Stipes of sterile fronds about 0.2 - 1 cm long, of fertile ones about 1 - 3 cm long, 1 - 2 cm apart, glabrous or sparsely scaly, articulate to rhizome. Fronds dimorphic, small; sterile lamina about 2 - 5 x 0.8 - 1.5 cm, variable in size and shape, usually obovate-elliptical or orbicular or spathulate-lanceolate, cuneate or slightly tapering at base, round or obtuse at apex, margin entire; texture somewhat fleshy, coriaceous when dry; venation reticulate, hidden; fertile lamina 4 - 6.5 x 0.2 - 0.4 cm wide, linear-lanceolate, narrowed gradually at base, rather broadly rounded or obtuse at apex; texture similar to the sterile ones. Sori linear, adpressed, continuous forming a coenosoral line, intermediate between the costa and the margin, soon covering almost all the undersurface except at the very margins; sori covered with clathrate, peltate scales when young; scales circular, margin with long protruberances.

Not common, collected only once from a moist, rather exposed tree trunk in forest.

Fertile: October.

Distribution: KOREA, TAIWAN, CHINA, NEPAL, BHUTAN, JAPAN, INDIA - North India, Sikkim, at 600 - 1500 m elevation, Meghalaya at 150 - 600 m elevation.

Specimens examined: Jamir 6544 Wokha (Wokha dist., 1414 m).

6. Pyrrosia

Mirbel, Hist. Nat. Pl. 4: 70. 1803; Nayar & Chandra Bull. Nat. Bot. Gard. No. 117: 1. 1965; Copel.,Gen. Fil. 192. 1947.

Usually epiphytes, often lithophytic. Rhizome creeping, scales usually peltate, entire or fringed with hairs, not clathrate. Stipes articulate to rhizome. Fronds simple, rarely palmately or hastately lobed, shortly stalked, entire, fleshy, covered (mostly when young) with stellate hairs, texture coriaceous; veins obscure, irregularly anastomosing with free, included veinlets, lateral veins visible or not; pitted, hydathodes borne on upper surface in some species. Sori copious, round to oval, usually borne on the upper half of the frond, superficial or somewhat immersed, more or less covered with stellate hairs (usually when young); spores bilateral.

A genus of about 25 species; 9 species so far collected from Nagaland.

K E Y T O S P E C I E S

1a. Fronds dimorphic.

2a. Sterile fronds linear obovate, slightly different from fertile fronds . . adnascens

2b. Sterile fronds circular or oval, much different from the fertile ones . .nummularifolia

1b. Fronds monomorphic, or the fertile slightly smaller than the sterile ones.

3a. Stellate hairs on frond dense and woolly.

4a. Sori throughout the lower surface.

5a. Lamina linear-lanceolate . . . *stenophylla*

5b. Lamina otherwise.

6a. Lateral veins well developed; rhizome scales with marginal tubercles at the tip . . . . . *heteractis*

6b. Lateral veins obscure; scales entire . . . . . *flocculosa*

4b. Sori on the more or less upper half of lamina; lamina oblanceolate.

7a. Rhizome scales linear . . . . . *mannii*

7b. Rhizome scales lanceolate . . . . . *mollis*

3b. Stellate hairs on fronds scattered, not woolly, arms short, adpressed.

8a. Lateral main veins visible . . . *lingua*

8b. Lateral main veins not visible . . . . *nuda*

Pyrrosia adnascens (Sw.) Ching in Bull. Chin. Bot. Soc. 1: 45. 1935; Holttum, Fl. Malaya 2: 144. Pl. 60. 1968; DeVol & Kuo, Fl. Taiwan, 1: 205 (ed.2). 1980; Dhir Ferns N.W. Himalayas 118. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 74. 1982.

Polypodium adnascens Sw., Syn. Fil. 25, 22, t. 2. 1806;

Clarke in Trans. Linn. Soc. Ser. 2(Bot.) 1: 552. 1880.

Epiphytes. Rhizome about 0.2 cm wide, long-creeping, more or less densely covered with brown to pale-brown, ovate-lanceolate scales; scales about 0.3 cm long, margin fimbriate. Stipes 0.2 - 1.5 cm long, scaly at base, glabrous above. Fronds dimorphic, thickly fleshy; lower surface covered with adpressed, stellate hairs with short arms, upper surface with a few stellate hairs or absent, without pitted hydathodes; sterile fronds 4 - 8 x 0.5 - 1.2 cm, obovate, shortly stalked, cuneate at base, apex obtuse or rather acute, upper surface clothed with scattered adpressed stellate hairs; midrib prominently raised, veins obscure. Fertile fronds 7 - 15 x 0.3 - 0.5 cm, linear to oblanceolate, obtuse, or acute at apex, narrowly decurrent on stipe, upper 1/2 - 2/3 of lamina soriferous, often basal portion or below the middle somewhat broader; fertile part of lamina curving backwards when dry. Sori small, round, dark-brown, depressed, sunk in the tomentum, covering from costa up to margin; sporangia oval, slender stalked; spores round, bilobed; exine tuberculate.

Abundant on tree trunks in open places. Sometimes completely enveloping the tree trunks.

Fertile: May - February.

Distribution: MALAYA, CHINA, TAIWAN, PHILIPPINES, POLYNESIA, FIJI, MASCAREEN, ISLANDS, SRI LANKA AND INDIA - Throughout India from Plains up to 1372 m elevation, northeast India.

Specimens examined: Jamir 7104 Changki (Mokokchung dist., 1000 m); 7035, 7066 Changki Tzulu (Mokokchung dist., 250 m); 6614 Mon (Mon dist., 898 m).

It is a polymorphous fern with extreme variation in size of fronds. The fronds are dimorphic and this should serve well to distinguish it from Pyrrosia lanceolata (Linn.) Farewell, with which it has frequently been confused in the past (Clarke, 1880; Beddome, 1883). Further, this fern differs from P. lanceolata in subglabrous or sparsely hairy under-surface of fronds. Upper 1/3 or 1/2 portion of the frond is fertile (Mehra & Bir, 1964).

Pyrrosia flocculosa (D.Don) Ching in Bull. Chin. Bot. Soc. 1: 66. 1935; Baishya & Rao, Ferns & Fern-allies Meghalaya 75. 1982.

Polypodium flocculosum D. Don, Prodr. Fl. Nepal 1. 1825; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 554 - 555. 1880.

Niphobolus flocculosus (D.Don) Bedd., Ferns Brit. India 331. 1883.

Epiphytes or lithophytes. Rhizome short-creeping, rather stout, densely covered with linear, brown, hair-tipped scales; scales about 1 x 0.1 cm; roots fibrous, densely compact covering the rhizome. Stipes 7 - 15 cm long, terete, scaly at base, and more or less with pale or brownish stellate tomentum above; lamina 10 - 30 x 2.5 - 6.5 cm, deltoid to oblanceolate, slightly

oblique or unequally hastate at base, slightly attenuate or decurrent on stipe, narrowly acuminate at apex, margin entire glabrous and rather blackish punctate above when old; lower surface clothed with dense, whitish or pale-brownish, stellate tomentum or hairs throughout; midrib prominently raised; veins obscure. Sori copious, globose, depressed, arranged in regular rows between the costules; sporangia oval, slender stalked, intermixed with stellate hairs; spores oval to kidney-shaped, pale-brown; exine finely grooved.

Frequent on moist, mossy rocks and also on tree trunks in shady places in forests.

Fertile: July - October.

Distribution: BHUTAN, INDIA - Himalayas, Garwhal, up to 1524 m elevation, Meghalaya.

Specimens examined: Jamir 6045 Peren (Kohima dist., 1446 m).

Pyrrosia heteractis (Mett. ex Kuhn.) Ching in Bull. Chin. Bot. Soc. 1: 57. 1935; Baishya & Rao, Ferns & Fern-allies Meghalaya 75. 1982.

Polypodium heteractis Mett. ex Kuhn. in Linnaeae 36: 140. 1869; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 557. 1880.

Niphobolus heteractis (Mett. ex Kuhn.) J. Smith, Ferns Brit. For. ed. 2: 296. 1877; Bedd., Handb. Ferns

Brit. India 327. 1883.

Niphobolus lingua Bedd., Ferns Brit. India Suppl. 22, t. 385. 1876 (non Spring, 1827).

Epiphytes or lithophytes. Rhizome up to 0.4 cm wide, wide-creeping, wiry, branched, densely covered with thin, pale-brown, linear-lanceolate scales; scales about 1 x 0.2 cm, ciliate towards the tip, cells rather clathrate at base. Stipes up to 25 cm long, terete, clothed with more or less stellate hairs; lamina 10 - 25 x 2 - 5 cm, elliptic or oblong with a long acuminate apex; upper surface glabrous, lower surface clothed with pale-brown, stellate hairs with filamentous hairs admixed; texture coriaceous; midrib and lateral veins prominently raised, almost reaching the margin. Sori rather large, globose, prominent, depressed, usually scattered throughout; sporangia oval, short stalked; mixed with stellate hairs; spores round, pale-brown, hyaline; exine slightly grooved.

Common on moist tree trunks as well as on moss-covered rocks.

Fertile: July - December.

Distribution: BHUTAN up to 1220 - 1830 m elevation; INDIA - Sikkim Himalayas, Meghalaya at 915 - 1525 m elevation.

This species is often confused with similar P. lingua (Thunb.) Farewell, a Japanese species. But P. heteractis differs in having filamentous hairs radiating round the scales and broader oblong-lanceolate fronds with long acuminate apex and sori more or less scattered throughout the lower surface. Further P. lingua is extremely rare.

Specimens examined: Jamir 7918, 6113, 6123 Kohima (Kohima dist., 1445 m).

Pyrrosia lingua (Thunb.) Farewell, Amer. Midl. Nat. 12: 302. 1931; Holttum, Studies in the Fl. Thailand 230. 1965; DeVol & Kuo, Fl. Taiwan 1: 206. 1980.

Acrostichum lingua Thunb., Fl. Jap. 330. 1784.

Cyclophorus lingua (Thunb.) Desv., Prod. 224. 1827; Ogata, Icon. Fil. Jap. 1: Pl. 16. 1928.

(Plate 35)

Rhizome about 0.3 cm wide, long creeping, wiry, more or less densely covered with adpressed, imbricate, dark to pale-brown, lanceolate scales; scales about 0.3 cm long, margin fimbriate. Stipes 1 - 4 cm long, articulate to rhizome, 1 - 2.5 cm apart; fronds up to 5 - 12 x 1 - 2 cm, obovate to oblanceolate, cuneate and rather short decurrent at base, broadest in the middle, gradually tapering to an acuminate apex; margin entire and thickened; lower surface densely covered with short, pale-brown stellate hairs, upper surface sparsely covered with stellate hairs or sometimes glabrous;

texture thick, coriaceous; lateral main veins visible, parallel, reaching the margin. Sori round, golden-brown, shining, covering completely or upper half of the lamina from costa to margin, covered with stellate hairs; sporangia oval, slender-stalked.

Rare, collected only once from a fallen tree trunk of Schima wallichii.

Fertile: February.

Distribution: JAPAN, TAIWAN, CHINA, VIETNAM, THAILAND.

Specimens examined: Jamir 7019 Changki (Mokokchung dist., 1000).

A new record for India.

Pyrrosia mannii (Gies.) Ching, in Bull. Chin. Bot. Soc. 1: 55. 1935; Dhir, Ferns N.W. Himalayas 116. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 75. 1982.
Niphobolus mannii Gies. Farngatt. Niph. 107. 1901.
N. fissus Hook. Sp. Fil. 5: 48. 1867; Bedd., Handb. Ferns Brit. India 330. 1883 (Partim.)
Cyclophorus perosus C. Chr., Ind. Fil. 200. 1905 (Partim).

Epiphytes. Rhizome short-creeping, more or less densely covered with ferrugineous, brown, narrow-lanceolate scales; scales about 0.4 cm long; roots fibrous, covered with brown ramenta. Fronds 5 - 10 x 0.5 - 1 cm, oblanceolate, narrowly tapering at both ends, usually narrowly winged to base, gland-

dotted on upper surface, densely covered with pale to reddish-brown, ferrugineous, woolly stellate tomentum on the lower surface; texture coriaceous; veins hidden. Sori copious, small, round, dark to reddish-brown, arranged in upper half of the frond; sporangia short-stalked; spores oval, yellow.

Common on moist tree trunks.

Fertile: August - December.

Distribution: INDIA - Meghalaya, N.W. Himalayas.

Specimens examined: Jamir 7933 Kohima (Kohima dist., 1445 m).

Pyrrosia mollis (Kunze.) Ching in Bull. Ching. Bot. 1: 53. 1935; DeVol & Kuo, Fl. Taiwan 1. 207 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 75. 1982.
Niphobolus mollis Kunze., Bot. Zeit. 6: 121. 1848.
N. fissus Bedd., Ferns Brit. India Correction 2. 1870; et Handb. Ferns Brit. India 330. t. 179. 1883.

Epiphytes. Rhizome short-creeping, densely covered with brown, ferrugineous, narrowly lanceolate-acuminate scales; scales about 0.6 cm long, margin light-brown, fimbriate; roots fibrous, densely clothed with brown ramenta; stipes 0.3 cm long. Fronds 12 - 30 x 1 - 2.5 cm, oblanceolate, tapering at both ends, usually winged almost to base, broadest somewhat in the middle, upper surface with pitted hydathodes,

and sparsely adpressed stellate hairs; lower surface finely tomentose, hairs ferruginous, woolly stellate, yellowish to reddish-brown with spreading rays; veins hidden; soriferous in the upper half of the frond. Sori copious, small, round or oval, scattered from costa up to margin, dark-brown; sporangia short-stalked; spores oval, yellow.

Common on moist tree trunks in forests.

Fertile: July - November.

Distribution: CHINA, PHILIPPINES, TAIWAN, INDIA - Himalayas, Meghalaya.

Specimens examined: Jamir 6129 Kohima (Kohima dist., 1445 m); 6234 Changki (Mokokchung dist., 1000 m); 6538 Wokha (Wokha dist., 1314 m).

Pyrrosia nuda (Gies.) Ching in Bull. Chin. Bot. Soc. 1: 70. 1935; Baishya & Rao, Ferns & Fern-allies Meghalaya 76. 1982.

Niphobolus nudus Gies. Farngatt. Niph. 149. 1901.

Small ephiphytes. Rhizome about 0.3 cm wide, wide-creeping, branched, blackish-brown, more or less densely covered with dark to pale-brown scales; scales attached slightly above the base, lanceolate, long ciliate, about 0.3 cm long, basal cells clathrate. Stipes 1 - 3 cm long, dark or purplish-brown, scaly at base; sparsely stellate hairy above. Fronds 10 - 20 x 0.8 - 1.3 cm, linear-lanceolate, gradually tapering

at both ends, broadest somewhat near base, margin entire, and curving backwards at maturity;upper surface glabrous or sparsely hairy; lower surface compactly clothed with stellate hairs, usually sterile fronds broader than the fertile ones; texture thick, coriaceous; soriferous usually at upper half of the lamina, midrib prominently raised; veins obscure or hidden. Sori globose, depressed, covering the upper half of the lamina except the apex; sporangia oval, short-stalked; spores round, dark-brown; exine grooved.

Very common, on tree trunks in open places. Sometimes this is confused with P. adnascens.

Fertile: December - February.

Distribution: INDIA - Meghalaya.

Specimens examined: Jamir 7034 Tzulu (Mokokchung dist., 1000 m); 6398 Kohima (Kohima dist., 1445 m); 6694 Tejit (Mon dist., 100 m).

Pyrrosia nummularifolius (Sw.) Ching, in Bull. Chin. Bot. Soc. 1: 47. 1935; Holttum, Fl. Malaya 2: 144. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 76. 1982.

Acrostichum nummularifolia Sw., Syn. Fl. 191. 419, t. 2. f. 1, 11806.

Niphobolus nummularifolius J. Smith in J. Bot. 3: 396. 1841; Bedd., Handb. Ferns Brit. India 334. 1883.

Epiphytes. Rhizome about 0.1 - 0.2 cm wide, slender, wide-creeping, branched, densely covered with pale-brown, ferruginous, lanceolate, narrow-fibrillose, hair-tipped scales; scales about 0.6 cm long, margin with few long spreading hairs. Fronds dimorphous; carnose-coriaceous; sterile fronds about 1.5 - 4 x 1 - 1.5 cm, almost circular to broadly ovate or elliptical, shortly stalked; upper surface glabrous or naked; lower surface densely clothed with loose, ferruginous woolly-tomentum; fertile fronds about 3 - 8 x 0.3 - 0.7 cm, narrowly oblong, base gradually narrowed, apex bluntly obtuse or rounded, shortly-stalked, stalks up to 2 cm long, lower surface usually almost completely covered with sori which are embedded by a thick layer of pale-brown hairs; veins rather reticulate, forming irregular areoles, marginal veinlets free. Sori round, close, scattered, sometimes covering the whole lower surface of lamina; spores round, yellowish-brown; exine with irregularly scattered long projections.

Abundant; usually on exposed tree trunks.

Fertile: October - February.

Distribution: CHINA, PHILIPPINES, SUMATRA, BHUTAN, BANGLADESH, INDIA - North India, Assam and Meghalaya.

Specimens examined: Jamir 6184, 7022, 7025 Changki (Mokokchung dist., 1000 m); 6700, 6616 Mon (Mon dist., 898 m).

Pyrrosia stenophylla (Bedd.) Ching, Bull. Chin. Bot. Soc. 1: 55. 1935.

Niphobolus fissus Hook. var. stenophyllus Bedd., Handb. Fern. Brit. India 330. 1880.

Epiphytes. Rhizome short-creeping, densely covered with dark to pale-brown, narrowly lanceolate, hair-tipped scales; scales up to 0.5 cm long. Stipes 2 - 6 cm long; roots fibrous, clothed with brown ramenta; fronds 15 - 45 x 0.3 - 1 cm, linear, narrowly tapering at both ends; upper surface covered with sparsely stellate hairs; lower surface also covered with finely ferruginous tomentum; stellate hairs, pale-yellowish to reddish-brown; texture coriaceous; veins obscure; soriferous usually throughout except at very base and apex. Sori small, round or oval, reddish-brown, scattered from costa up to margin; sporangia shortly-stalked; spores oval.

Common in moist tree trunks, rather in open forests.

Fertile: December.

Distribution: CHINA, INDIA.

Specimens examined: Jamir 7130, 7922 Kohima (Kohima dist., 1445 m).

7. Drymoglossum

Presl, Tent. Pterid. 227. 6. 1836; C. Chr., Ind. Fil. 246. 1906; Copel.,Gen. Fil. 194. 1947.

Epiphytes. Rhizome wide-creeping, slender, covered with peltate scales. Fronds simple, entire, fleshy, remote, sparsely stellate hairy, dimorphous; veins obscure, areoles irregularly reticulate with free or included veinlets; sterile fronds much shorter and broader than fertile ones; sporangia in a continuous row on either side of the midrib, medial, exindusiate, covered with stellate paraphyses; annulus of 14 - 18 cells; spores bilateral.

The generic name is derived from Drymos = wood; glossa = tongue.

Drymoglossum heterophyllum (Linn.) Trimen in J. Linn. Soc. 24: 152. 1887; Baishya & Rao, Ferns & Fern-allies Meghalaya 60. 1982.

Acrostichum heterophyllum Linn., Sp. Pl. 2: 1067. 1753.

Drymoglossum piloselloides (Linn.) Presl, Tent. Pterid. 227, t. 10. 1836; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 575. 1880; Bedd., Handb. Ferns Brit. India 441, Pl. 244. 1883; Holttum, Fl. Malaya 2: 149. 1968.

(Plate 36)

Epiphytes. Rhizome up to 0.1 cm wide, wide-creeping, wiry, densely scaly; scales small, adpressed, ovate to round, peltate,

hair-tipped, centre dark, margin paler, lacerate on both ends. Stipes of sterile fronds up to 0.3 cm long; of fertile fronds 0.5 - 2 cm long, 1 - 2 cm apart, more or less covered with scales similar to rhizome. Fronds dimorphous; sterile lamina 1.5 - 3 x 1 - 2 cm, nearly circular to obovate, narrowed gradually or cuneate at base; broadly rounded at apex, margin entire; texture very thick, fleshy, more or less covered with stellate hairs when young, rather glabrous at maturity; midrib visible in basal half of lamina, veins immersed, areoles with copious free veinlets. Fertile lamina 3 - 10 x 0.5 - 0.8 cm, linear-oblong, narrowed gradually to the base, broadly rounded at apex; texture and hairs similar to that of sterile lamina. Sori up to 0.2 cm or more wide, linear, confluent along the tip of lamina; sporangia oval, short stalked, dark-brown, accompanied by stellate paraphyses; spores oval to elliptic, hyaline, light brown; exine tuberculate.

Common on tree trunks rather in exposed places in low lands.

Fertile: October - February.

Distribution: BURMA, SRI LANKA, JAVA, PHILIPPINES, JAPAN, CHINA, SUMATRA, NEW GUENIA, INDIA - South India, common in Malabar plain, also on the mountains up to about 600 m elevation; north India, Bengal plains; Meghalaya.

Specimens examined: Jamir 7023, 7024 Changki Tzulu (Mokokchung dist.,250 m); 6699 Tejit (Mon dist., 100 m).

8. Arthromeris

J. Smith, in Hook. Fil. Fl. N. Zeal. 2: 43. 1854; C. Chr., Ind. Fil. 62. 1906; Copel.,Gen. Fil. 209. 1947.

Usually terrestrials or epiphytes, sometimes on mossy rocks. Rhizome wide-creeping, thick, fleshy; densely covered with brown lanceolate scales. Stipes articulate to rhizome, glabrous. Fronds pinnate, with a few pairs of lateral pinnae, lateral veins distinct, parallel, reticulations not distinct, free, areoles with included forked veinlets. Sori round or spherical, rather large, brown, single or in many rows between the lateral veins.

A genus of about 8 species; 2 in Nagaland.

K E Y T O S P E C I E S

Scales on rhizome shining brown; sori in a regular row on either side of the midrib, 2 - 4 mm across . . . . . wallichiana

Scales on rhizome dull white; sori in more than one row on either side of the midrib, more or less irregular, 1 - 2 mm across . . lehmanni

Arthromeris lehmanni (Mett.) Ching, Contr. Inst. Bot. Acad. Peiping 2: 96. 1933; Mehra & Bir, Res. Bull. Panjab. Univ. (N.S.) 15: 173. 1964; Dhir, Ferns N.W. Himalayas 129. 1980; DeVol, Fl. Taiwan 1: 166 (ed.2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 54. 1982.

Polypodium lehmanni Mett. Pol. 117, no. 229. t. 3, f.35. 1857; Clarke in Trans. Linn. Soc. Lond. Ser. 2 (Bot.) 1: 566. 1880.

Pleopeltis lehmanni Bedd., Ferns Brit. India t. 260. 1868; et Handb. Ferns Brit. India 370. t. 211. 1883.

Epiphytes. Rhizome 0.4 - 0.7 cm across, long creeping, rather stout, round, more or less densely covered with whitish- or pale yellowish scales; scales up to 0.8 x 0.2 cm, broad at base, linear lanceolate, margin serrate, hooked, hair-tipped. Stipes 7 - 25 cm long, erect, tough, shining, glabrous, dark-purplish, distant, articulate to rhizome; lamina 15 - 35 x 15 - 35 cm, pinnate; lateral pinnae 2 - 8 or more pairs, opposite or subopposite, sessile, articulate to rachis; with a single terminal pinna similar in size and shape with lateral ones; largest pinna up to 15 x 2.2 cm, ovate-lanceolate, rather obliquely cuneate or cordate at base, broadest somewhat in middle, gradually tapering into a long caudate acuminate apex, margin entire or slightly undulate, texture subcoriaceous; both surfaces of lamina glabrous; rachis purplish-brown, glabrous, shining; lateral main veins prominent, parallel nearly to the margin; areoles hidden, with many veinlets. Sori up to 0.2 cm wide, round, superficial, 1 - 6 in between each pair of lateral veins; sporangia oval, slender-stalked; spores reni-shaped, brown; exine papillate.

Not common; on tree trunks as well as on branches in dense evergreen forests at high altitudes.

Fertile: October - December.

Distribution: BURMA, THALAND, CHINA, TAIWAN, INDIA - Himalayas and Meghalaya.

Specimens examined: Jamir 7261 Japvo hill (Kohima dist., 2460 m); 6363 Morong forests, Sangpur (Tuensang dist., 1000 m).

Arthromeris wallichiana (Spring) Ching, in Contr. Inst. nat. Acad. Peking 2: 92. 1933; Dhir, Ferns N.W. Himalayas 129. 1980.

Polypodium wallichianum Spring, Syst. 4: 53. 1827.

Pleopeltis juglandifolia (D.Don) Moore, Ind. Fil. 78. 1857; Bedd., Handb. Ferns Brit. India Suppl. 368. 1892.

Polypodium juglandifolium D. Don, Prodr. Fl. Nepal. 3. 1825.

Pleopeltis capitellata Bedd., Ferns Brit. India t. 12. 1863.

Plate 37)

Terrestrials as well as epiphytes. Rhizome about 1 cm wide, creeping, solid, stout, densely covered with broad or linear lanceolate, ciliate, reddish-brown, ferruginous scales; scales up to 1.3 x 0.4 cm. Stipes 12 - 30 cm or more long, erect, hard, shining, glossy-glabrous, purplish-brown, articulate to rhizome; lamina 25 - 45 x 20 - 30 cm; lateral pinnae 3 - 10 pairs, widely spaced, opposite or subopposite, sessile, articulate to the rachis; largest pinna up to 25 x 4.5 cm, oblanceolate, rather round or obliquely cordate at base, often

attenuated and subsessile; margin thickened, wavy, rarely lobed; narrowly lanceolate, caudate at apex; texture subcoriaceous, both surfaces glabrous, rachises dark to purplish-brown, glossy, shining, glabrous; lateral main veins prominent, parallel, running up to the margin, areoles many, hidden, with free, veinlets. Sori up to 0.5 cm wide, globose, in a solitary row between the main lateral veins, forming a single row, much closer to the midrib than the margin, rarely in two rows; sporangia with slender stalks; spores oval, brown; exine spinulose.

Very common on moist shady tree trunks, but also grows on moss-covered terrestrial habitats.

Fertile: July - January.

Distribution: BURMA, INDIA - Himalayas, Sikkim up to 1220 - 2439 m elevation; Meghalaya.

Specimens examined: Jamir 6161 Pfutsero (Phek dist., 2134 m); 7143 Kohima (Kohima dist., 1445 m); 6360 Morong forests (Tuensang dist., 2134 m).

9. Crypsinus

Presl, Epim. Bot. 123. 1849; C.Chr., Ind. Fil. 186. 1906; Copel., Gen. Fil. 205. 1947.

Epiphytes, sometimes terrestrials. Rhizome rather long-creeping, densely covered with scales; scales lanceolate with long terminal hair-like tips. Stipes articulate to rhizome. Fronds simple, entire, deeply lobed, glabrous;

veins prominent, forming irregular areoles with free, included veinlets. Sori large, globose, sporangia slender stalked; annulus oblique; spores bilateral, spinulose.

A genus of about 40 species; 5 species collected in Nagaland including description of a new species.

K E Y T O S P E C I E S

1a. Lamina simple, lanceolate . . . . . griffithiana

1b. Lamina pinnately or more or less palmately divided.

2a. Lobes crenate; spores smooth . . . . . crenatopinnatus

2b. Lobes entire or wavy; spores spinulose or smooth.

3a. Lobes of lamina usually more than 5; spores spinulose.

4a. Margin of pinna lobes smooth, thin in texture; main lateral nerves not raised on lower surface . . . . . oxyloba

4b. Margin of pinna lobes cartilaginous, repand on drying, texture coriaceous; lateral nerves raised on the lower surface . . . . . hastata

3b. Lobes of lamina 5; spores smooth . . . . . nagalandensis

Crypsinus crenatopinnatus (Clarke) Copel., Gen. Fil. 206. 1947; Baishya & Rao, Ferns & Fern-allies Meghalaya 58. 1982.

Polypodium crenatopinnatum Clarke in Trans. Linn. Soc. 25: 99, t. 42. 1880.

(Plate 38)

Terrestrials or epiphytes. Rhizome about 0.2 cm wide, creeping, covered with hairs and scales; hairs simple, unicellular; scales about 0.2 cm long, peltate, lanceolate, abruptly hair-tipped, margin toothed, Stipes 12 - 20 cm long, pupplish-brown, shining, glabrous, ridged on the lower surface. Fronds deltoid to ovate-lanceolate in outline; lamina about 10 - 20 x 6 - 12 cm, cuneate at base, deeply pinnatifid near to the rachis, with 3 - 7 pairs of lateral pinnae and a single apical lobe with crenate margin; the lowest pair of lobes largest, oblanceolate, slightly oblique at base, round or obtuse at apex, margin crenate; texture thin, subcoriaceous, glabrous on both surfaces of lamina; venation conspicuous; costae and lateral veins distinct, veinlets reticulate, obscure, Sori up to 0.3 cm wide, rather large, biseriate, globose, copious in between lateral veins in segments; sporangia oval; dark brown; spores oval, hyaline, light yellow; exine smooth.

Frequent, on tree trunks in forests.

Fertile: October - November.

Distribution: INDIA - Meghalaya.

Specimens examined: Jamir 6309 Shamator (Tuensang dist., 1692 m).

Crypsinus griffithiana (Hook.) Copel. Gen. Fil. 206. 1947;
Baishya & Rao, Ferns & Fern-Allies Meghalaya 59. 1982.

Polypodium griffithianum Hook. Icon. Fil. t. 951. 1854.
Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 510. 1880.

Pleopeltis griffithiana (Hook.) Bedd., Handb. Ferns Brit. India 354. t. 199. 1883.

Phymatodes griffithiana (Hook.) Ching in Contrib. Inst. Bot. nat. Acad. Peiping 2: 71. 1933.

Rhizome 0.2 - 0.4 cm wide, wide-creeping, wiry, densely covered with adpressed, pale-brown, ovate-lanceolate, hair-tipped scales; scales about 0.7 x 0.2 cm. Stipes 6 - 15 cm long, erect, slender, glabrous; lamina 15 - 30 x 2 - 6 cm, simple, lanceolate to ovate-lanceolate, cuneate or slightly alternate at base, acuminate at apex, margin brownish when dry; glabrous on both surfaces; main veins very distinct up to the margin, areoles fine, hidden by copious, free, simple or forked veinlets. Sori up to 0.4 cm wide, rather large, globose, close to midrib, biseriate, usually occupying upper half of lamina; sporangia oval, dark-brown; spores oval to elliptical, yellow; exine smooth.

Extremely common, both on tree trunks as well as creeping on mossy rocks, either in shady or exposed places at higher elevations.

Fertile: May - June.

Distribution: BHUTAN at 1830 - 2744 m elevation, INDIA - Sikkim, Meghalaya at 1220 - 1525 m elevation.

Specimens examined: Jamir 7147 Kohima peak (Kohima dist., 1445 - 2347 m elevation).

Crypsinus hastata (Thunb.) Copel., Gen. Fil. 206. 1947; DeVol & Kuo, Fl. Taiwan 1: 174. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 59. 1982.

Polypodium hastatum Thunb., Fl. Jap. 335. 1784.

Pleopeltis hastatus Moore, Ind. Fil. 346. 1862; Bedd., Handb. Ferns Brit. India 362. t. 205. 1883 (pro parte)

Phymatodes hastata (Thunb.) Ching in Sinensia 3: 344. 1933; Dhir, Ferns N.W. Himalayas 126. 1980.

Rhizome up to 0.3 cm wide, creeping, rather stout, densely covered with pale to reddish-brown, broad based, linear-lanceolate, hair-tipped scales; scales about 0.6 x 0.1 cm, finely ciliate, margin with small projections. Stipes 10 - 20 cm long, purplish-brown, shining, glabrous, articulate to rhizome. Fronds deltoid to ovate-acuminate in outline, pinnatifid nearly reaching the rachis, with 2 - 6 pairs of lateral lobes and a single apical lobe; largest lobe about 7 - 20 x 2-3 cm, broad at base, oblanceolate, acuminate, margin slightly thickened, cartilaginous, repand, on drying; the lowest pair of lobes cuneate or decurrent to upper stipe; texture thin, firm coriaceous, glabrous above, undersurface somewhat glaucous; venation conspicuous, costae and costules clearly distinct, forming 3 - 4 series of primary areoles, which are filled with smaller included free veinlets. Sori up to 0.5 cm

wide, rather large, globose, dark-brown, not sunk, superficial, in a single row on each side of costa; sporangia slender stalked; annulus of 10 - 17 thickened cells; spores elliptical to bean-shaped with an oblique, distinct aperture, yellow; exine spinulose.

Very common, on tree trunks as well as on moss covered rocks and grounds.

Fertile: July - August.

Distribution: KOREA, JAPAN, TAIWAN, CHINA, PHILIPPINES, INDIA - Throughout India on the mountainous regions, South India at 1525-2622 m elevation; North India at 300 - 3048 m elevation.

Specimens examined: Jamir 6148 Pfutsero (Phek dist., 2134 m).

Crypsinus nagalandensis, sp. nov.

(Plate 39)

Rhizome up to 0.4 cm wide, creeping, rather stout, densely clothed with dark-brown, broad based, linear-lanceolate, hair-tipped scales; scales 0.5 x 0.1 cm. Stipes up to 15 cm long, slender, dark-purplish, shining, glabrous, articulate to rhizome. Fronds deltoid to ovate-acuminate in outline, deeply cut down nearly reaching the rachis; lateral lobes 2 pairs, with a single terminal lobe similar to lateral ones, the lowest pair somewhat largest to the next above, up to 15

x 4 cm, broadest at base oblong-lanceolate, gradually tapering into lanceolate-acuminate apex, margin broadly wavy or undulate, slightly thickened; texture thick, firm, coriaceous, glabrous on both surfaces of lamina, brown when dry; midrib and costae prominent, dark-brown, shining, glabrous; costules clearly distinct, pale-brown, runs up to margin from costa, areoles fine, obscure. Sori 4 - 5 mm wide, large, usually globose, dark-brown, arranged in a single line on either side of costa and more closer than margin; sporangia slender stalked; annulus 15 - 17 cells; spores elliptic to bean-shaped; exine smooth.

Rare on tree trunks in thick forests.

Fertile: December.

Distribution: INDIA - Nagaland.

Specimens examined: Jamir 6148, Pfutsero (Phek dist., 2000 m) HOLOTYPE (Herbarium of North-Eastern Hill University Shillong (NEHU). The present species is closely related to Crypsinus hastata and C. oxyloba but differs in having fronds which are clearly only 5-lobed with their margins entire or slightly repand and with distinct primary areoles; and in having smooth spores. (It is proposed to deposit the Holotype in CAL after the valid publication of this taxon).

(Valid publication of this species is however in process).

Crypsinus oxyloba (Wall. ex Kze) Sledge in Bull. Brit. Mus. (Nat. Hist.), 2: 145. 1960.

Polypodium oxylobum Wall. ex Kunze, Linnaea 24: 255. 1851.

Pleopeltis hastata sensu Bedd. Handb. Ferns Brit. India 362. 1883 (pro parte).

Phymatodes oxyloba (Wall. ex Kze) Presl, Tent. Pterid. 196. 1836; Mehra & Bir in Res. Bull. Panjab Univ. (N.S.) 15: 171. 1964; Dhir, Ferns N.W. Himalayas 126. 1980.

Rhizome up to 0.5 cm across, short-creeping, rather stout, densely covered with thin, dark-brown, ferruginous, ovate-lanceolate, hair-pointed scales; scales up to 0.5 x 0.2 cm. Stipes up to 8 - 18 cm long, purplish-brown, shining, glabrous, articulate to rhizome. Fronds 20 - 40 x 15 - 30 cm, sometimes more, deltoid to subcordate, acuminate in outline, deeply cut down nearly almost to the rachis into lobes or pinnules; lateral pinnae 3 - 6 pairs with a single terminal pinna quite similar to lateral ones; largest pinnae 8 - 18 x 2.5 - 4.5 cm, oblanceolate to obovate lanceolate in outline; broadest at base, gradually tapering into lanceolate, acuminate apex, margin slightly thickened, usually entire or smooth; texture thin, subcoriaceous; lamina glabrous above, rather glaucous beneath; venation conspicuous; main lateral veins not prominently raised on lower surface, distant, forming 2 - 4 series of primary areoles, filled by free veinlets. Sori up

to 0.3 cm wide, large, globose, brown, not sunk, arranged in two rows, one on either side of costule between the lateral vein; sporangia stalked; annulus of 7 - 9 thickened cells; exindusiate, spores elliptical or bean-shaped, yellowish, exine spinulose.

Common on moist tree trunks as well as on moss-covered rocks in forests.

Fertile: October - December.

Distribution: INDIA - Darjeeling, Nainital & Sikkim.

Specimens examined: Jamir 6333 Shamator (Tuensang dist., 1600 m); 7296 Japvo (Kohima dist., 1200 m),

10. *Microsorum

Link., Hort. Berol. 2: 110. 1833; C. Chr., Ind. Fil. 429. 1906; Copel., Gen. Fil. 195. 1947.

Epiphytes or growing on mumus (humus!) and moss-covered rocks. Rhizome usually wide-creeping or climbing, more or less densely covered with peltate, clathrate (at least the middle) dark-brown scales. Stipes articulate to rhizome. Fronds usually simple or rarely pinnate, coriaceous, glabrous;

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* Nair et Bennet (Bull. bot. Surv. India 11: 432. 1969) have given the correct spelling of the generic epithet as Micosorum and not Microsorium as it is spelt in most of the works.

venation reticulate, often hidden, areoles with included, simple or forked veinlets. Sori copious, globose, superficial, scattered irregularly; paraphyses absent; sporangia slender stalked; annulus oblique; spores bilateral.

A genus of about 40 species; 3 species reparted from Nagaland.

K E Y T O S P E C I E S

1a. Lamina membranous; veins prominently raised . . . . . membranaceum

1b. Lamina not or slightly membranous; veins obscure.

2a. Fronds sessile; midrib grooved; sori scattered, more or less immersed along the upper half of lamina . . punctatum

2b. Frounds slender stipitate; midrib not grooved; sori superficial, throughout the surface . . . . . superficiale

Microsorum membranaceum (D. Don) Ching, in Bull. Fan. Mem. Inst. Biol. 4: 309. 1933; Nayar in Bull. nat. Bot. Gard. Lucknow 58: 17. 1961; DeVol & Kuo, Fl. Taiwan 1: 196. 1980; Dhir, Ferns N. W. Himalayas 131. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 67. 1982.

Polypodium membranaceum D. Don Prodr. Fl. Nepal 2. 1825.

Pleopeltis membranacea Bedd., Handb. Ferns Brit. India 355. 1883.

(Plate 40)

Terrestrials, often epiphytic. Rhizome up to 1 cm wide, short-creeping, rather stout, the apical part covered with ovate-acuminate, entire, blackish-brown scales; scales about 0.5 x 0.3 cm or more. Stipes 5 - 15 cm long, almost narrowly winged, Fronds 40 - 75 x 6 - 15 cm, elliptic to obovate-lanceolate, narrowly decurrent to stipe, broadest somewhat in the middle, gradually tapering to an acuminate apex, margin entire, glabrous, texture thin, membranous, pale greenish to brownish when dry; veins prominently raised, reticulate; lateral main veins distinct, parallel, 7 - 10 cm apart, with included veinlets, forming numerous areoles. Sori up to 0.2 cm wide, rather small, round to globose, yellowish-brown, irregularly scattered along the veinlets between the main veins.

Common on moist, shady, humus covered rocks along river banks and streams. Sometimes grows as epiphytes on moss-covered tree trunks. Very variable with regard to the size of fronds.

Fertile: July - October.

Distribution: SRI LANKA, VIETNAM, CHINA, TAIWAN, PHILIPPINES, BHUTAN, INDIA - Himalayas, Garwhal at 900 - 1500 m elevation, South India between 600 - 1500 m elevation.

Specimens examined: Jamir 6235, 6220 Changki (Mokokchung dist., 1000 m); 6349 Peren (Kohima dist., 1446 m); 6326

Morong forests, Sangpor (Tuensang dist., 2136 m); 6540 Wokha (Wokha dist., 1314 m).

Microsorum punctatum (Linn.) Copel., Univ. Calif. Publ. Bot. 16: 111. 1929; Holttum, Fl. Malaya 2: 179. 1968; DeVol & Kuo, Fl. Taiwan 1: 197 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 68. 1982.

Acrostichum punctatum Linn., Sp. Pl. ed. 2: 1524. 1753.

Polypodium punctatum Sw. in Schrad. J. 1800, 2: 21. 1801; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 561. 1880.

Pleopeltis punctatum (Linn.) Bedd., Handb. Ferns Brit. India 357, t. 201. 1883.

(Plate 41)

Epiphytes or often on moss covered rocks. Rhizome 0.5 - 1 cm wide, scarsely creeping, stout, rather sparsely covered with thick clathrate, peltate, blackish-brown scales; scales ovate-acuminate, 0.3 x 0.1 cm, margin toothed; fronds 60 - 100 cm x5 - 10 cm, simple, linear-lanceolate, sessile or with short stipes (about 1 cm long), broadest in middle, very gradually tapering almost to the base, apex obtuse or acute, margin entire; texture coriaceous, leathery, glabrous, pale-greenish to brown when dry; midrib prominently raised on both surfaces; veins visible, but not prominent, areole copious with included veinlets. Sori abundant, small, round, irregularly scattered usually on upper half of the lamina; sporan-

gia oval, short-stalked; dark-brown,hyaline, exine finely verrucoid.

Very common in moist shady places on tree trunks or on humus and moss-covered rocks at low altitudes. One of the nest-forming species.

Fertile: May - February.

Distribution: AFRICA, VIETNAM, CHINA, TAIWAN, PACIFIC ISLANDS, MALAYA, AUSTRALIA, POLYNESIA, SRI LANKA, INDIA - Western ghats up to 900 m elevation, North India, Sikkim.

Specimens examined: Jamir 6181, 7102, 7984 Changki (Mokokching dist., 1000 m).

Microsorum superficiale (Blume) Ching in Bull. Fan. Mem. Inst. Biol. 4: 299. 1933; Baishya & Rao, Ferns & Fern-allies Meghalaya 68. 1982.

Polypodium superficiale Blume, Enum. Pl. Jav. Fil. 123. 1828; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 557. 1880.

Pleopeltis superficialis Bedd., Ferns Brit. India t. 75. 1865,

(Plate 42).

Rhizome up to 0.5 cm wide, scandent, more or less densely covered with thin, ovate-lanceolate, clathrate, brownish scales; scales up to 0.4 x 0.2 cm, margins denticulate. Stipes 4 - 15 cm long, slender, dark-brown, sometimes sparsely

covered with brown, ovate scales; fronds 15 - 40 x 2 - 5 cm, linear-lanceolate, gradually narrowed at both ends, margin entire, often sinuate; texture subcoriaceous, glabrous, dark-green when dry; veins obscure, areoles numerous with free veinlets. Sori up to 0.3 cm wide, rather large, copious, round to oval, superficial, irregularly scattered throughout the surface of lamina, yellowish when young.

Very common, usually grows on tree trunks; often forms ground vegetation.

Fertile: December.

Distribution: CHINA, MALAYA, BHUTAN, INDIA - Arunachal Pradesh and Meghalaya at 1400 - 1500 m elevation.

Specimens examined: Jamir 6231 Changki (Mokokchung dist., 1000 m); 6110, 6462, 6480 Kohima (Kohima dist., 1445 m); 6433 Zenheboto (Zenheboto dist., 1875 m).

11. Kaulinia

Nayar in Taxon, 13: 67. 1944.

Terrestrials. Rhizome creeping, brittle, dorsiventral; palea gland-tipped, auricled at base with glandular hairs; marginal hairs lacking. Fronds articulate to rhizome, simple to pinnatisect, herbaceous, sparsely hairy and scaly on both surfaces; veins articulate. Sori numerous, dorsal, superficial scattered or in regular rows on the lower surface of lamina, sometimes confluent forming coenosori; paraphyses present;

spores bilateral.

A genus of few species; 2 in Nagaland.

K E Y T O S P E C I E S

Slender; lamina 3-lobed or sometimes simple; stipes 6 - 10 cm long; midrib paleate . . . . . pteropus

Robust; lamina pinnately divided into several pairs of pinnae; stipes 20 - 40 cm long; midrib glabrous . . . . . hancockii

Kaulinia hancockii (Baker) Nayar in Taxon 13: 67. 1964; Baishya & Rao, Ferns & Fern-allies Meghalaya 62. 1982.

Polypodium hancockii Baker in J. Bot. 116. 1889.

Microsorium dilatatum (Bedd.) Sledge in Bull. Brit. Mus. (Nat. Hist.) Bot. 2: 143. 1960; Ching in Acta Phytotax. Sin. 9: 372. 1964.

Polypodium dilatatum Wall. ex Hook. Sp. Fil. 5: 85. 1863.

Pleopeltis dilatata Bedd., Ferns Brit. Infia 367. 1883.

Microsorium hancockii (Baker) Ching in Sunyatsenia 5: 1940; Holttum Fl. Malaya 2: 174. 1968.

(Plate 43)

Rhizome about 1 cm across, short-creeping, stout, densely covered with dark-brown, clathrate, peltate, linear-lanceolate acuminate scales; scales about 0.8 x 0.2 cm. Stipes 20 - 40 cm long, erect, rather stout, scaly at base, glabrous above,

winged at base on either side of the axis; lamina 20 - 45 x 15 - 30 cm, unipinnate; linear-oblong, acuminate or slightly toothed or repand, terminal lobe with 7 - 15 pairs of lateral lobes, rather oblique and decurrent to rachis, slightly widening above the base, largest lobe up to 25 x 3 cm, oblanceolate or narrowly lanceolate, acuminate at apex, margin entire; texture thin, membranous, light-green, glabrous on both surfaces; main lateral veins prominently raised on lower surface, not reaching the margin; other secondary veins hardly raised, irregular with free included veinlets. Sori copious, globose, oval, often more or less elongate or confluent, dorsal on veinlets, irregularly scattered throughout the lamina; sporangia slender stalked; spores oval to bean-shaped, greenish-yellow; exine finely verrucoid.

Frequent on moist, rather shady rocks near stremas and river banks.

Fertile: July - August.

Distribution: VIETNAM, CHINA, TAIWAN, JAPAN, NEPAL, BHUTAN, MALAYA, SRILANKA, INDIA - North India; Meghalaya at 700 - 1825 m elevation.

Specimens examined: Jamir 6080 Kohima (Kohima dist., 1445 m); 6321 Morong forests, Sangpore (Tuensang dist., 2136 m); 6478 Kohima (Kohima dist., 1445 m).

Kaulinia pteropus (Blume) Nayar in Taxon 13: 67. 1964; Baishya & Rao, Ferns & Ferh-allies Meghalaya 62. 1982.

Polypodium pteropus Blume, Enum. P. Jav. 168, t.76. 1828.

Microsorium pteropus (Blume) Ching, Bull. Fan. Mem. Inst. 4: 312. 1933; et in Sunyatsenia 5: 1940; Holttum, Fl. Malaya 2: 172. Pl. 80. 1968.

(Plate 44)

Rhizome up to 0.3 cm across, creeping, fleshy, green, the apical part densely covered with narrow, dull-brown, entire, lanceolate scales; scales about 0.3 cm long; roots wide spreading, clothed with ramenta. Stipes 2 - 12 cm long, narrowly winged in the upper part, more or less sparsely covered with scales throughout. Fronds simple or deeply trilobed; simple lamina about 20 x 3 cm, narrowly winged at the stipe, lanceolate, acuminate, margin entire, trilobed or tripinnate lamina with terminal lobe about 20 x 2.5 cm, similar in shape as the simple lamina; lateral basal pair of lobes about 12 x 1.5 cm, linear-lanceolate, more or less tapering to a gradually decurrent wing at base, all lobes scaly or the midribs beneath; scales ovate-lanceolate, entire, pale-brown, finely rugose on the upper surface; texture thin, subcoriaceous, dirty, dark-green to blackish when dry; venation very conspicuous; main veins prominent beneath, extending about 2/3 of the way to the margin and then uniting to form large costal areoles, similarly second series of

smaller areoles formed nearer the margin, the rest of the lamina arranged with a network of smaller, irregular areoles, including free, simple or forked veinlets with clavate apices. Sori small, globose, often forming coenosori along the veins, scattered irregularly within the main areoles; sporangia oval, slender stalked, with linear hair-like paraphyses; spores oval to elliptic, light-yellow, hyaline; exine smooth.

Occasional on moist, shady rocks near streams and rivers.

Fertile: November - January.

Distribution: CHINA, MALAYA, PHILIPPINES, BHUTAN, BANGLA DESH, INDIA - North India, Sikkim at 300 - 1220 m elevation, Meghalaya up to 1200 m elevation.

Specimens examined: Jamir 7038 Changki (Mokokchung dist., 1000 m).

12. Leptochilus

Kaulf., Enum. Fil. 147. 1824; C. Chr., Ind. Fil. 384. 1906; Copel., Gen. Fil. 197. 1947.

Rhizomes wide creeping, often climbing, branched; scales clathrate, dark-brown, deciduous, lanceolate. Fronds distinctly dimorphic; lamina simple, glabrous, entire; sterile fronds ovate to lanceolate, sessile or with short stipes; fertile fronds narrow, long stipitate; veins reticulate, with numerous

areoles, included veinlets copious, simple or branched, ending in hydathodes; lateral veins not well developed. Sori acrostichoid; sporangia with paraphyses, exindusiate; spores reniform, elliptic.

About 12 species; only 1 in Nagaland.

Leptochilus axillaris (Cav.) Kaulf., Enum. 147, t. 1,f. 10. 1824; Holttum, Fl. Malaya 164. 1968.

Acrostichum axillare Cav., Ann. Hist. Nat. 1: 101. 1799; Clarke in Trans. Linn. Soc. ser. 2 (Bot.) 1: 579. 1880.

Gymnopteris variabilis (Hook.) Bedd., var. axillaris (Cav.) Bedd., Handb. Ferns Brit. India 430. 1883.

Rhizome up to 0.4 cm wide, creeping, sparsely covered with small, narrow, thin, clathrate, dark-brown, ovate-lanceolate scales; scales about 0.4 cm long, sparsely toothed at margin. Stipes 0.5 - 3 cm long, pale-brown, glabrous or sparsely scaly at base, articulate to rhizome. Fronds dimorphic, glabrous; sterile fronds 25 - 45 x 3 - 5 cm, gradually narrowed at both ends, broadest in the middle, decurrent on stipe, margin ehtire; texture, thin, veins forming oblique, polygonal main areoles, each divided into 2 - 3 smaller ones, containing branched, free veinlets. Fertile fronds about 20 - 45 x 0.3 - 0.5 cm, undersurface densely covered with sporangia

except for the midrib and very thin margin; the margin slightly reflexed at maturity; sori exindusiate, sporangia dark or yellowish-brown; paraphyses linear, spores elliptic, hyaline, light brown; exine smooth.

Frequent, creeping on moist rocks or twining among bushes in shady forests near streams and rivers.

Fertile: October - November.

Distribution: MALAYA, BURMA, INDIA - South India, W. Bengal, Assam, Meghalaya.

Specimens examined: Jamir 7929 Kohima (Kohima dist., 1445 m).

13. Paraleptochilus

Copel., Gen. Fil. 198. t. 7. 1947.

Terrestrials. Rhizome usually creeping, dorsiventral with numerous stiff roots projecting downwards. Fronds dimorphic; veins well developed, raised, secondary veins copiously arching with branched, included veinlets, ending in dark hydathodes. Fertile fronds with apparently long slender stipes. Sori acrostichoid; sporangia stalked, hairy; spores oval to elliptical; exine pitted.

A genus of ? species; 1 in Nagaland.

Paraleptochilus decurrens (Blume) Copel., Gen. Fil. 198. t. 7, 1947.

Leptochilus decurrens Blume, Enum. Pl. Jav. 2: 206. 1828; Holttum, Fl. Malaya 164. 1968.

Acrostichum variabile Hook., Sp. Fil. 5: 277. 1864; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 578 - 579. 1880.

Gymnopteris variabilis (Hook.) Bedd., Handb. Ferns Brit. India 429, t. 258. 1883.

(Plate 45)

Rhizome up to 0.5 cm wide, long creeping, the apex rather densely covered with clathrate, dark-brown, narrowly lanceolate, hair-tipped scales; scales about 0.4 cm long. Fronds dimorphic; stipes of sterile fronds winged nearly to the base, about 5 - 15 cm long; stipes of fertile fronds, about 15 - 25 cm long, not distinctly winged; sterile fronds 25 - 55 x 7 - 10 cm, broadly ovate-lanceolate, suddenly cuneate towards base, gradually winged on the base of stipe, shortly acuminate at apex, margin entire; texture thin; lateral main veins parallel, very distinct on both surfaces, nearly reaching the margin; venation reticulate with included veinlets; marginal veins free. Fertile fronds 30 - 55 x 0.5 - 1 cm, covered entirely beneath with sori, margin slightly reflexed at maturity. Sori exindusiate; sporangia acrostichoid, oval slender-stalked, mixed with hairs; spores oval to elliptical, light-brown, hyaline; exine finely pitted.

Frequent, near moist shady places near rivers and streams; occasionally also on rocks and bases of tree trunks.

Fertile: May - June.

Distribution: MALAYA, VIETNAM, CHINA, TAIWAN, PHILIPPINES, POLYNESIA, BHUTAN, BURMA, INDIA - Assam, Sikkim, Meghalaya and South India.

Specimens examined: Jamir 7195 Meluri (Phek dist., 1000 m).

14. Colysis

Presl, Epim. Bot. 146. 1849; C. Chr., Ind. Fil. 185. 1906; Copel., Gen. Fil. 198. 1947.

Terrestrials, usually growing on humus or moss-covered rocks. Rhizome long-creeping, dictyostelic, scales small, dark, clathrate, ovate-lanceolate, Stipes often winged nearly to the base, articulate to rhizome. Fronds simple or pinnately lobed, glabrous, membranous; veins reticulate, forming series of areoles with included, free veinlets. Sori linear, continuous or short, oval and interrupted, oblique to costa, in one row between each pair of main veins; sporangia stalked, paraphyses absent; spores numerous, bilateral.

A genus of 30 species; 5 in Nagaland.

K E Y T O S P E C I E S

1a. Fronds entire.

2a. Fertile fronds much smaller than the sterile ones; sori continuous . . . *pedunculata*

2b. Fertile and sterile fronds similar; sori not continuous . . *hemionitidea*

1b. Fronds pinnatifid or pinnate.

3a. Fronds pinnatifid.

4a. Fronds pinnatifid with a broad wing on each side of the rachis; pinnae up to 12 x 2 cm . . . *elliptica* var. *pothifolia*

4b. Fronds pinnatifid with very narrow wing on each side of rachis or almost wingless; pinnae up to 30 x 4 cm . . *elliptica*

3b. Fronds pinnate . . . . . *longisora*

Colysis elliptica (Thunb.) Ching, in Bull. Fan. Mem. Inst. Biol. 4: 333. 1933; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim Himalayas 174. 1964; DeVol & Kuo, Fl. Taiwan 1: 170. (ed. 2). 980; Dhir, Ferns N.W. Himalayas 130. 1980.

Selliguea elliptica Bedd., Handb. Ferns Brit. India 392. t. 227. 1883.(*Pro parte*).

Gymnogramma elliptica Hook. & Baker, Syn.Fil. 389. 1874.

Rhizome up to 1 cm wide, wide-creeping, stout, densely covered with dark-brown, clathrate, thin, ovate-lanceolate,

hair-tipped scales; scales about 0.6 x 0.2 cm. Stipes 30 - 60 cm or more long, erect, straw-coloured, articulate to rhizome; lamina 25 - 60 x 15 - 45 cm, large, cordate-ovate in outline; deeply pinnatifid nearly or quite to the rachis into 3 - 10 pairs of lateral lobes or segments, with a single apical segment which is quite similar to the lateral ones; largest lobe 30 x 5 cm, linear, oblanceolate, narrowed at base, acuminate at apex, margin entire, base decurrent on stipe forming a wing; texture subcoriaceous, greenish-brown when dry, glabrous on both surfaces; veins obscure or the main lateral veins slightly visible. Sori linear, oblique to costa, usually continuous along the lateral veins, sometimes interrupted; sporangia globose, dark-brown; spores oval to elliptical, hyaline, light-brown; exine with blunt projections.

Common in dense evergreen forests as well as on humus and moss-covered rocks in forests. One of the very variable species with many varieties.

Fertile: July - December.

Distribution: NEPAL, BHUTAN, MALAYA, PHILIPPINES, CHINA, TAIWAN, JAPAN, LOREA, QUEENSLAND AND FORMOSA, INDIA - Himalayas, Meghalaya at 600 - 1500 m elevation.

Specimens examined: Jamir 6381, 6397 Mezenkong (Mokokchung dist., 1326 m).

Colysis elliptica var. pothifolia (D.Don) Ching in Bull. Fan. Mem. Inst. Biol. 4: 333. 1933; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim 174. 1964.

Hemionitis pothifolia D. Don, Prodr. Fl. Nepal 13. 1825.

Colysis pothifolia (D.Don) Presl, Epim. Bot. 148. 1849.

Polypodium pothifolium Mett. Fil. Lips. 130. t. 25, f. 21. 1856.

Selliguea elliptica Bedd., Handb. Ferns Brit. India 392. 1883 (Pro parte).

Gymnogramma elliptica Clarke in Trans. Linn. Soc. Lond. Ser. 2 (Bot.) 1: 570. 1880 (pro parte).

Rhizome up to 8 mm across, long creeping, rather stout, more or less densely covered with brown, clathrate lanceolate, hair-tipped scales; scales up to 6 mm long. Stipes 8 - 15 cm or more long, erect, dark to pale-brown, articulate to rhizome; lamina 18 - 25 x 10 - 18 cm, cordate to ovate-lanceolate, in outline, deeply pinnatifid near to the rachis into lobes; lateral lobes 4 - 10 cm long, usually opposite with a terminal lobe quite similar to lateral ones in shape and size; largest segment or lobe 15 x 2.5 cm, linear or oblanceolate, gradually tapering towards base, broadest somewhat near the middle, gradually narrowed into an acuminate apex, margin entire or slightly undulate; texture subcoriaceous dark-green when dry, glabrous on both surfaces of lamina; veins not very distinct. Sori up to 0.8 cm long, linear, oblique to costa, not reaching the margin; sporangia globose, dark-brown; spores oval, hyaline; exine slightly projecting.

Frequent; grows on humus covered rocks in dense forests. Often this variety is treated as a distinct species.

Fertile: July - December.

Distribution: NEPAL, BHUTAN, MALAYA, PHILIPPINES, QUEENSLAND, FORMOSA, INDIA - Himalayas, Meghalaya.

Specimens examined: Jamir 6595 Mezenkong (Mokokchung dist., 1325 m).

Colysis hemionitidea (Presl) Presl, Epim. Bot. 147. 1849; Baishya & Bao, Ferns & Fern-allies Meghalaya 57. 1982.
Selligua hemionitidea Presl, Tent. Pterid. 216, t. 9, f. 17. 1836.
Pleopeltis hemionitidea (Presl) Moore Ind. Fil. 436. 1862; Bedd., Ferns South India t. 182. 1863.
Polypodium hemionitideum Wall. ex Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 561. 1880. (Plate 46)

Rhizome up to 0.4 cm wide, wide-creeping, densely clothed with brown ramenta and with clathrate, pale-brown, linear-lanceolate scales; scales about 0.3 cm long. Stipes 0.5 - 4 cm long, short, covered with scales similar to rhizome scales. Fronds 30 - 80 x 4 - 10 cm, simple, usually broadly lanceolate, broadest in middle, gradually acuminate and narrowly attenuate at base and winged nearly throughout the stipe; margin entire or slightly undulating; texture membranous, shining, dark-green when dry, glabrous on both surfaces of lamina, veins

much prominent, lateral main veins blackish-brown, distinct, nearly parallel, areolae with included, branched veinlets. Sori oblong-elongate or round, rather large, interrupted, borne in one row between the lateral veins; sporangia slender stalked; spores minute, oval, dark; exine thick.

Very common, on moist shady forest floor; and also grows along river banks and streams; rarely grows as epiphytic on mossy tree trunks.

Fertile: May - October.

Distribution: NEPAL, VIETNAM, CHINA, PHILIPPINES, MALAYA INDIA - South India, Sikkim and Meghalaya.

Specimens examined: Jamir 6176, 7004, 7119 Changki (Mokokchung dist., 1000 m); 6064 Peren (Kohima dist., 1445 m); 7927 Kohima (Kohima dist., 1445 m).

Colysis pedunculata (Hook. et Grev.) Ching in Bull. Fan. Mem. Inst. Biol. Bot. 4: 321, 1933; Holttum, Fl. Malaya 2: 160. 1968; DeVol & Kuo, Fl. Taiwan 1: 170. Pl. 58 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 57. 1982.

Ceterach pedunculata Hook. et Grev. Icon. Fil. t. 5. 1827.

Gymnogramme hamiltoniana Hook., Sp. Fil. 5: 160. 1864.

Silliguea hamiltoniana Bedd., Ferns Brit. India t. 239. 1867.

(Plate 47).

Rhizome up to 0.4 cm wide, wide-creeping, often climbing, rather woody, covered with dark-brown, clathrate, narrow, lanceolate-acuminate, hair-tipped scales; scales about 0.3 cm long; roots wiry, clothed with dark-brown ramenta. Stipes of sterile fronds about 15 - 25 cm long, winged in the upper part nearly to the base; stipe of fertile fronds about 25 - 40 cm long, winged only at upper part. Fronds dimorphic; sterile lamina 18 - 30 x 6 - 10 cm, obovate-lanceolate in outline; broadest near base and suddenly narrowed at base to a wing of the stipe; gradually tapering into a shortly acuminate apex; margin entire, sometimes wavy; texture thin, coriaceous, main lateral veins prominently raised on both surfaces near to the margins; nearly parallel, with many intermediate areoles, with free included veinlets. Fertile lamina 8 - 15 x 2.5 - 5 cm, narrowly ovate-lanceolate, acuminate, much more contracted than the sterile lamina. Sori linear, compact, continuous from midrib up to margin, throughout the surface of lamina between the main lateral veins; sporangia oval, slender-stalked, accompanied by multicellular hairs. Spores oval, hyaline, light-brown; exine with blunt projections.

Rare, grows on moist humus covered rocks or on bases of tree trunks near rivers and streams.

Fertile: February.

Distribution: MALAYA, NEPAL, BANGLADESH, INDIA - North Eastern Himalayas, Arunachal Pradesh, at 1200 m elevation.

Specimens examined: Jamir 7027 Changki, Longnakza (Mokokchung dist., 250 m).

Colysis longisora (Bak.) Ching in Bull. Fan. Mem. Inst. Biol. 4: 331. 1933; Dixit & Ghose in Bull. Bot. Surv. India 20: 101. 1978.

Gymnogramme longisora Bak. in J. Bot. 267. 1890.

Rhizome up to 0.5 cm wide, wide-creeping, slender, densely covered with pale to dark-brown, clathrate, ovate-lanceolate, hair-tipped scales; scales up to 0.5 x 0.1 cm. Stipes up to 45 cm long, stramineous, glabrous, smooth, pale to straw coloured when dry; lamina up to 30 x 25 cm, imparipinnate; lateral pinnae 5 pairs, opposite or subopposite; largest pinnae 16 x 3.5 cm, oblong-lanceolate, gradually attenuate at base, broadest somewhat at the middle, acuminate or acute or often obtuse at apex, margin entire to slightly repandolous; all pairs of pinnae decurrent to adnate, except the lowest shortly-stalked or slightly decurrent, with a single terminal quite similar to lateral ones; texture thin, firm, pale-greenish on lower surface, slightly dark on upper surface of the lamina; glabrous on both surfaces; venation reticulate, areoles small, hexagonal, usually with a free included veinlet. Sori up to 1.5 cm long, linear, brown, oblique to costae, extending from costae almost nearly to the margin; spores small, monolete, pale, verrucoid.

Not very common; collected only once from a moss-covered rocks in dense forests.

Fertile: December.

Distribution: INDIA - Manipur at 1,500 m elevation.

Specimens examined: Jamir 6471 Kohima (Kohima dist., 1450

15. Pseudodrymaria

Verdoorn's Manual 548. 1938; C. Chr. ex Ching, Sunyatsenia 5: 262. 1940; et in Bull. Nat. Bot. Gard. no. 56: 17. 1961; Copel., Gen. Fil. 201. 1947.

Epiphytes, sometimes lithophytes. Rhizome dictyostelic, massive, thick, with humus collecting habit, covered with brown scales. Fronds dimorphic, sterile fronds fused with fertile ones, coriaceous, glabrous or paleate; lamina deeply cleft, pinnatifid. Veins conspicuously raised, lateral veins nearly parallel, distinctly reticulate with included veinlets. Sori round to linear, often forming coenosori or confluent in a single row in between lateral veins; spores bilateral.

A genus with only one species.

Pseudodrynaria coronans (Wall. ex Mett.) Ching in Sunyatsenia 5: 357. 1940; DeVol & Kuo, Fl. Taiwan 1: 214. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 73. 1982.

Polypodium coronans Wall. ex Mett., Farngatt. Polypod. 121, t. 40, 1857; Clarke, in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 556. 1880.

Drynaria coronans (Wall. ex Mett.) Bedd., Ferns Brit. India t. 13. 1865; et Handb. Ferns Brit. India 388, t. 187. 1883.

Epiphytes as well as on rocks. Rhizome 2 - 5.5 cm wide, massive, thick, creeping, dark-brown, branched, densely covered with linear, entire, golden-brown, hair-tipped scales; scales up to 1.5 cm long; fronds 50 - 100 x 20 - 35 cm, large, sessile, cordate at base; basal portion dilated, brown, humus collecting; upper part of fronds lobate-pinnatifid, oblanceolate in out line; largest segment up to 12 - 25 x 2 - 4 cm, linear, oblanceolate, acuminate, margin entire, wavy; texture coriaceous; rachis and stipe densely brown scaly when young; lateral veins prominently raised beneath, parallel, smaller cross veins forming areoles with included veinlets. Sori small, round to elongate, usually confluent in a single row along tertiary veins, dorsal, superficial; spores round, yellow.

Very common, on tree trunks in forests; sometimes grows on humus covered rocks. Rhizome very massive forming bands on

tree trunks. Fronds sometimes attain very large size.

Fertile: July - October.

Distribution: CHINA, TAIWAN, NEPAL, BHUTAN, BANGLADESH, MALAYA, HONGKONG, FORMOSA, INDIA - Himalayas, Meghalaya at 600 - 1000 m elevation.

Specimens examined: Jamir 6601 Mon (Mon dist., 898 m); 6412 Tejit (Mon dist., 200 m); 6241 Mepongchuket (Mokokchung dist., 1300 m).

16. Drynaria

(Bory) J. Snith J. Bot. 4: 60. 1841; C.Chr., Ind. Fil. 247. 1906; Copel., Gen. Fil. 203. 1947.

Epiphytes, rarely terrestrials. Rhizome fleshy, creeping, dictyostelic, covered by non-clathrate scales with ciliate margins. Fronds dimorphic, one type small, short, broad, sessile, soon turning brown like oak leaf and covering rhizome for collecting humus for the roots; venation anastomosing; other type large, deeply pinnatifid or pinnate, green; fronds articulate to rhizome; veins copious, inarching larger areoles, containing smaller ones and branched veinlets. Sori round, exindusiate, borne on junction of veins; sporangia stalked; annulus 10 - 15 celled; spores bilateral.

A genus of about 20 species; 2 in Nagaland.

K E Y T O S P E C I E S

Sterile fronds deeply lobed, overlapping the fertile ones; sori biseriate, along the costae . . . . . quercifolia

Sterile fronds pinnatifid, distant from the fertile ones; sori scattered throughout the lamina between lateral veins . . . . . propinqua

Drynaria propinqua (Wall. ex Mett.) J. Smith in J. Bot. 4: 62. 1842; Bedd., Handb. Ferns Brit. India Suppl. 339, t. 189. 1892; Nayar in Bull. Nat. Bot. Gard. Lucknow 56: 9. 1961; Dhir, Ferns N. W. Himalayas 131. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 61. 1982.

Polypodium propinquum Wall. ex Mett., Farngatt. Polypod. 120. 1857.

Epiphytes. Rhizome up to 0.5 cm across, creeping, fleshy, densely covered with thin, yellowish-brown, linear-lanceolate, acuminate to hair-tipped scales; scales about 0.8 x 0.1 cm. Stipes 8 - 20 cm long, articulate to rhizome. Fronds dimorphic, glabrous; sterile fronds up to 8 - 15 x 10 - 12 cm, obovate to cordate-ovate in outline, greenish when young, but soon turning dark-brown, glossy, distant on the rhizome, much smaller than fertile ones, deeply lobed, pinnatifid, nearly reaching the costa; lobes up to 6 x 1 cm, entire, glabrous,

coriaceous; veins finely reticulate. Stipes of fertile fronds about 8 - 25 cm long, pale-brown, glabrous, articulate to rhizome; lamina 20 - 50 x 15 - 35 cm, deltoid to obovate in outline, glabrous, deeply cut down very near or quite to the rachis into segments; segments numerous, subopposite or alternate; largest segment up to 25 x 2 cm, linear, oblanceolate, acuminate or obtuse at apex, margin shallowly crenate or entire; texture rather thick, coriaceous; veins prominently raised on ventral surface, reticulate, areoles copious, with a few free veinlets. Sori copious, globose, hairy, in a single row on either side of the midrib; spores globose to oval, yellowish-brown, spinulose.

Exceedingly common throughout the state specially at low altitudes, densely covering the tree trunks.

Fertile: May - October.

Distribution: MALAYA, BURMA, JAVA, BHUTAN, INDIA- Himalayas 600 - 2000 m elevation; and Meghalaya.

Specimens examined: Jamir 6056 Peren (Kohima dist., 1446 m); 6502 Wokha (Wokha dist., 1314 m); 7121 Changki (Mokokchung dist., 1000 m); 6302 Shamator (Tuensang dist., 1692 m); 6388 Mezenkong (Mokokchung dist., 1326 m).

✓ Drynaria quercifolia (Linn.) J. Smith in J. Bot. 3: 398. 1841; Bedd., Handb. Ferns Brit. India 341. t. 191. 1883; Holttum, Fl. Malaya 2: 182. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 61. 1982.

Polypodium quercifolium Linn., Sp. Pl. 1547. 1753.

Epiphytes. Rhizome rather stout, up to 2 cm across, creeping, densely scaley; scales dark-brown, linear, cordate, auricled at base, margin of auricle lacerate, ciliate at apex, lanceolate, hair-tipped, about 1.5 - 1.8 cm long; fronds dimorphic; sterile fronds up to 15 - 35 x 7 - 20 cm, overlapping the base of fertile fronds, green when young, but soon turning dark-brown, glossy, cordate-ovate, variously lobate-pinnatifid, often more or less half way down to the costa; lobes up to 4 x 2 cm, entire, glabrous, coriaceous; fertile fronds 50 - 1000 x 20 - 35 cm, ovate to oblanceolate in outline, pinnatisect, slender, stipitate; stipe up to 10 - 25 cm long, pale-brown, glabrous; segments numerous, subopposite or alternate, cut down nearly reaching the costa; largest segment or lobe up to 20 x 3 cm, oblanceolate, acuminate, entire; the lowest basal segment slightly shortened and decurrent on the axis giving a winged appearance; texture thin but stiffly leathery; glabrous on both surfaces; veins prominently raised, reticulate, costules rather oblique, slightly zig-zag, cross veins distinct, enclosing many smaller areoles with a few free veins. Sori copious, small, scattered throughout the surface of lamina in between lateral veins,

dorsal, superficial along veinlets; sporangia round, slender stalked; spores oval, hyaline, light-brown; exine with minute blunt projections.

Common both on shady as well as exposed tree trunks; often covering the whole length of tree trunks. Sometimes grows on rocks.

Fertile: May - July.

Distribution: CHINA, MALAYA, FIJI, TROPICAL AUSTRALIA, INDIA - Throughout the country in the plains or low land mountains.

Specimens examined: Jamir 7123 Changki (Mokokchung dist., 1000 m).

13. DIPTERIDACEAE

Terrestrials. Rhizome wide creeping, woody, stout, covered with very narrow, linear, dark, stiff scales; stelar organisation solenostelic. Stipes long, erect, slender, glabrous. Fronds remote, not articulate to rhizome, borne in two rows on the rhizome; lamina large, coriaceous, fan-shaped, divided to the base in two equal parts, each half dichotomously divided into more or less deeply lobed segments; venation reticulate, the main veins more or less equally and repeatedly dichotomous, lateral perpendicular veins forming complicated net work with free veinlets in the areoles. Sori small, round, exindusiate,

scattered throughout the surface; solitary in each areole, borne on junction of veinlets; sporangia small, intermixed with hair-like paraphyses, short stalked; annulus with ill-developed stomium; spores small, monolete, with nearly smooth exine.

Only genus of the family, Depteris.

Dipteris

Reinwardt, Sylloge Pl. 2: 3. 1824; C. Chr., Ind. Fil. 242. 1906; Copel., Gen. Fil. 177. 1947.

Characters of the family. A genus of about 8 species; 1 in Nagaland.

Dipteris wallichii (R.Br.) Moore, Ind. Fi. t. 80, 1857;

Bedd., Hand. Ferns.Brit. India 334. t. 184. 1883;

Baishya & Rao, Ferns & Fern-allies Meghalaya 60. 1982.

Polypodium wallichii R. Br. in Hook. et Grev., Icon. Fil. t. 168.-169, 1831; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 555. 1880.

(Plate 48)

Rhizome 1 - 1.5 cm across, clothed with copious, black, hard, subulate-setaceous scales which are wrinkled at the back. Stipes 30 - 60 cm long, smooth, dark-brown, polished, erect, hard, glabrous. Fronds coriaceous, 30 - 60 cm long and

much wider than long, glossy-green above, coppery-green beneath; lamina fan-like, cut into two parts, each part again dichotomously divided into palmate segments; segments 10 - 30 x 3 - 8 cm, oblong acuminate; costae from the summit of the stipe dichotomously, repeatedly branched with 2 main costae in each segment which are united at the apex. Veinlets branched at right angles to the main costae, another moving to form fine meshes with included veinlets; venation prominent beneath, reticulate, the main vein more or less equally and repeatedly dichotomous; lateral veins forming a complicated network with free veinlets in the areoles. Sori small, round, superficial, copious, scattered in the areoles; sporangia oval, light-brown, shortOstalked; spores small, oval, pale white, monolete; exine smooth.

Very rare, in open areas of mountainous regions; sometimes growing in dense patches eliminating other species. Also along roadsides in hilly forests.

Fertile: June - October.

Distribution: INDIA - North-east India.

Specimens examined: Jamir 6177 Changki (Mokokchung dist., 1000 m).

14. LYGODIACEAE

Terrestrials. Rhizome subterrenean, slender, creeping, short or long, dichotomously branched, covered with stiff, multicellular hairs, protostelic in organisation. Stipe slender with a single vascular bundle; rachis twining, indeterminate in growth, bearing very short primary branches, which end in a tuft of brown hairs, primary branches give rise to a pair of secondary branches, which are dichotomously branched, pinnae digitately lobed; lamina tripartite, dimorphic, bearing sterile and fertile parts; sterile pinnae entire or lobed; fertile narrower than sterile ones, bearing marginal lobes with two rows of sporangia; veins forked, usually free; sporangia large, short-stalked, in 2-rows; indusium small; annulus with thick-walled cells, dehiscing by a vertical slit; spores trilete, tetrahedral, numerous.

Only genus of the family, Lygodium Sw.

Lygodium

Sw. in Schrad. J. Bot. 1800; 2: 7. 1801 (nom. cons.); C. Chr., Ind. Fil. 1906; Copel. Gen. Fil. 24. 1947.

Climbing ferns, rachis twining, indeterminate in growth bearing short, primary branches which end in a tuft of brown hairs; secondary branches dichotomously branched; pinnae digitately lobed; lamina tripartite, dimorphic, bearing fertile and sterile parts; veins froked, usually

free. Sporangia subtended by an indusium-like outgrowth, marginal in biseriate spikes; annulus with thick-walled cells, apical or subapical. Spores trilete, tetrahedral, numerous.

A genus of about 40 species in tropical and subtropical regions; 2 species in Nagaland.

K E Y T O S P E C I E S

Pinnules 12 x 3.5 cm; sterile pinnules not lobed . . . . . flexuosum

Pinnules 4 x 0.5 cm; sterile pinnules 3 - 5-lobed, central lobe much elongated . . . . . japonicum

✓Lygodium flexuosum (Linn.) Sw. in Schrard. J. 2: 106. 1801; Syn. Fil. 153. 1806; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 584. 1880; Bedd., Handb. Ferns Brit. India 457, t. 283. 1883; Holttum, Fl. Malaya 57. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 37. 1982.

Ophioglossum flexuosum Linn., Sp. Pl. 1063. 1753.

(Plate 49)

Twining ferns. Rhizome creeping. Stipes 0.2 - 0.3 cm across, glabrous, slender, with a single vascular bundle. Fronds glabrous, wide spreading; branches of secondary rachis

12 - 40 x 10 - 30 cm, alternate, leaflets pinnate, 3 - 6 cm long, simple or terminal leaflets forked; basal leaflets often large, separate or lobed with 2 - 3 leaflets; leaflets 6 - 12 x 2.5 - 3.5 cm, broader at base and gradually narrowed to the apex; stalks 0.2 - 0.7 cm long; sterile leaflets finely toothed, texture firm; veins 1 - 3 forked, free, oblique or recurved; fertile leaflets a little narrower than the sterile one. Sori on 0.1 - 0.5 cm long lobes, protruding from the margin; sporangia large, short stalked, arranged in 2 rows; annulus with thick-walled cells, dehiscing by a vertical slit; spores small, trilete, numerous.

Common on jhummed and open areas, and on edges near cultivated fields. Often twining on bushes.

Fertile: February - December.

Distribution: SRI LANKA, MALAYA, PHILIPPINES, NORTH AUSTRALIA, TROPICAL AFRICA AND CHINA, INDIA - Most parts of India, and in Himalayas (up to 1524 m altitude).

Specimens examined: Jamir 7934, 7938 Rangapar (Kohima dist., 200 m); 7050, 7079 Changki (Mokokchung dist., 1000 m); 6553 Kohima (Kohima dist., 1445 m).

Lygodium japonicum (Thunb.) Sw. in Schrard. J. 2: 106. 1806; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 584. 1880; DeVol in Fl. Taiwan 1: 84 (ed.2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 37. 1982. Ophioglossum japonicum Thunb., Fl. Jap. 328. 1784.

Rhizome creeping; rachis twining, glabrous, bearing very short, pubescent primary branches, clothed with pale-brown hairs; secondary branches 2 - 8 cm long, opposite; sterile pinnules 3 - 5-lobed, central lobe much elongated, 1.5 - 4 x 0.5 - 1 cm, pubescent at base, margin crenate, often bipinnate; fertile pinnules shorter, much contracted, deeply lobed, 1 - 3 x 0.3 - 0.8 cm, Sori on 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; annulus dehiscing by vertical slit; spores small, numerous, tetrahedral, exine rugulose.

Not common; in moist open places, often twining on other bushes.

Fertile: July - November.

Distribution: AUSTRALIA, PHILIPPINES, CHINA, JAPAN, KOREA, MALAY ISLAND, INDIA - South India; Western ghats; North India: Kashmir up to 1550 m altitude and Meghalaya.

Specimens examined: Jamir 6419 Tijit (Mon dist., 200 m); 6493 Kohima peak (Kohima dist., 1445 m); 6132 Phek (Phek dist., 1200 m).

15. SINOPTERIDACEAE

Terrestrials. Rhizome short-creeping, suberect or ascending, clothed with narrow, entire scales. Stipes slender, blackish-polished, not articulate, sparsely hairy; rachis grooved on the upper surface. Fronds small, narrow to broadly deltoid, bipinnatifid to tripinnate, herbaceous, hairy, rarely glabrous, waxy, mealy white powdery or yellow, coriaceous, beneath; veins free. Sori marginal, terminal on the veins, more or less confluent with a false indusium of reflexed margin of the lamina; annulus of 14 - 30 thickened cells, stromium numerous, paraphyses absent; spores globose or tetrahedral, smooth or corrugated; exine granulose, rarely reticulate-spinulose.

A family consisting of 15 genera; 1 in Nagaland.

Cheilanthes

Sw., Syn. Fil. 5, 126. 1806; C. Chr., Ind. Fil. 171. 1906; Copel., Gen. Fil. 1947.

Small terrestrial ferns. Rhizome short-creeping, covered with small, narrow scales. Stipes slender, blackish, polished sparsely hairy. Fronds small, narrow to broadly deltoid, bipinnatifid or tripinnate, hairy or smooth; veins free. Sori marginal, confluent with a false indusium of reflexed margin of the lamina; annulus of 14 - 30-thickened cells; paraphyses absent; spores tetrahedral, smooth; exine granulose or reticulate, spinulose.

A genus of about 180 species, in all tropical and warm temperate regions; 4 in Nagaland.

K E Y T O S P E C I E S

1a. Fronds decompound or tripinnate, not glaucous-white beneath . . . . . tenuifolia

1b. Fronds uni-pinnate or bipinnate, glaucous-white powdery beneath.

2a. Scales on rhizome with white translucent margin . . . . . albomarginata

2b. Scales on rhizome brown, without translucent margin.

3a. Pseudo-indusium more or less interrupted . . . . . farinosa

3b. Pseudo-indusium continuous . . argentea

Cheilanthes albomarginata Clarke in Trans. Linn. Soc. Ser. 2 (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.

Aleuritopteris albomarginata (Clarke) Panigrahi in Bull. bot. Surv. India 2: 312. 1960.

Rhizome short, covered with hair-pointed scales; scales up to 0.6 cm long, blackish-brown, lanceolate, margin translucent; roots fibrous, with brown ramenta. Stipes 8 - 20 cm

long, slender, reddish-brown, shining, sparsely covered with lanceolate, hair-like, pointed scales; lamina 5 - 15 x 3 - 10 cm, deltoid to lanceolate, unipinnate with deeply pinnatifid pinnae, thickly covered beneath by lanceolate, brown scales (when young) and with yellowish or whitish powdery on the ventral surface, except rachis and costa which are scaly; lowest pair of pinnae half deltoid, lower pinnules much developed. Sori marginal, conflunet; indusium brown, margin lacerate.

Common along road cuttings on hills and among rock crevices.

Fertile: October - February.

Distribution: INDIA- N.W. Himalayas 1500 to 2000 m elevation and Meghalaya.

Specimens examined: Jamir 6198 Changki (Mokokchung dist., 1000 m).

Cheilanthes argentea (Gmel.) Kunze in Linnaea 23: 242. 1850; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 458. 1880; Bedd., Handb. Ferns Brit. India 158. 1883; Wang-chueng Shiek in Fl. Taiwan 1: 282 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 143. 1982. Pteris argentea Gmel. Nova Comm. Petr. 12: 519. 1768.

Rhizome short, ascending, covered with narrow, hair-pointed scales; scales up to 0.5 cm long, linear, dark-brown; roots fibrous, with dense, soft, pale-brown ramenta. Stipes 3 - 15 cm long, densely tufted, dark-brown, polished, clothed at base by lanceolate, hair-pointed scales; lamina 3 - 7 x 3 - 6 cm, triangular or deltoid, tripinnatifid, coriaceous; lowest pinnae largest, tripinnatifid; pinnae cut down to the rachis, decurrent; rachis and costa polished as the stipe; upper surface naked, green; lower or ventral surface glabrous, covered with white or yellow waxy powdery substance. Sori confluent, marginal; indusium entire, continuous, firm, crenate or serrulate at the margin.

Common along road cuttings and also among rock crevices. This species and the next species show overlapping characters and at times difficult to separate.

Fertile: October - February.

Distribution: CHINA, KOREA, SIBERIA, JAPAN, TAIWAN, MALAYA, BURMA, INDIA - Meghalaya at 915 - 1,544 m).

Specimens examined: Jamir 7056 Changki (Mokokchung dist., 1000 m); 6310 Shamator (Tuensang dist., 1692 m).

Cheilanthes farinosa (Forsk.) Kaulf., Enum. Fil. 212. 1824 (in part); Hook., Syn. Fil. 142. 1867; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 457. 1880; Bedd., Handb. Ferns Brit. India 92. 1883; Holttum, Fl. Malya 2: 592. 1968; Wang-chueng Shieh in Fl. Taiwan 1: 282 (ed. 2). 1980; Dhir, Fern N.W. Himalayas 37. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 144. 1982.

Aleuritopteris farinosa (Forsk.) Fee Gen. Fil. 154. t. 12B, f. 1. 1850 -52.

Pteris farinosa Forsk., Fl. Aegypt-Arab. 187. 1775.

(Plate 51)

Rhizome short, ascending, stout, clothed with scales; scales up to 0.8 cm long, blackish-brown, linear, hair-pointed roots fibrous, spreading. Stipes 4 - 22 cm long, eboneous glossy, dark-purplish, glabrous, polished, scaly at base; lamina 5 - 15 x 4 - 12 cm, oblong to lanceolate, bipinnate at base, pinnatifid at apex; basal pinnae in pairs, up to 7 cm long, pinnatifid with oblong, rounded lobes; ventral surface covered with whitish or yellowish waxy powdery substance, glabrous above; texture thin, coriaceous. Sori scarious, rounded, in a continuous line close to the margin, often lacerate; indusia free.

Very common, near ravines and on rock crevices; and also along roadsides.

Fertile: July - February.

Distribution: Throughout India.

Specimens examined: Jamir 6550 Chumrketema (Kohima dist., 250 m); 7078 Changki (Mokokchung dist., 1326 m).

Cheilanthes tenuifolia (Burm.f.) Sw., Syn. Fil. 129. 332. 1806; Clarke in Trans. Linn. Soc. Ser. (2 (Bot.) 1: 455. 1880; Bedd., Handb. Ferns Brit. India 92. 1883; Holttum, Fl. Malaya 2: 590. 1968; Wang-chueng Shiek in Fl. Taiwan 1 : 284. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 144. 1982.
Trichomanes tenuifolia Burm.f. Fl. Ind. 237. 1768.

Rhizome small, short, ascending or suberect, clothed with scales; scales up to 0.2 cm long, short, brownish, linear. Stipes 7 - 25 cm long, slender, erect, dark-purplish, sparsely covered by short, brown hairs throughout; lamina 5 - 20 x 3 - 10 cm, ovate-acuminate, glabrous, tripinnate, herbaceous; the lowest pinnae rather widely spaced, ultimate sterile pinnule oblong-lanceolate, obtuse, cuneate at base, subpinnatifid or crenate; the fertile pinnules similar to that of sterile ones but rather narrower; veins of upper surface not visible but distinct below, forked. Sori elongate, confined to lower leaflets in vein endings, continuous along the margins except near the base, protected by reflexed margin of the lamina; indusium very short, margin undulate; spores blackish, tetrahedral.

Abundant in foothills and plains.

Fertile: July - October.

Distribution: CHINA, SRI LANKA, MALAYA, TAIWAN, PHILIPPINES, AUSTRALIA, NEW ZEALAND, POLYNESIA, BANGLADESH, INDIA- South India Madras Presidency, Bengal, Assam, Sikkim, and Meghalaya.

Specimens examined: Jamir 6200 Changki (Mokokchung dist., 1000 m).

16. CRYPTOGRAMMACEAE

Terrestrials. Rhizome creeping, solenostelic, covered with scales. Stipes scaly at base, otherwise scabrous all along, not articulate to the rhizome. Fronds herbaceous or subcoriaceous, tripinnate or compound, glabrous; veins free. Sori elongate, submarginal along both margins; false indusium on each pinnule meet on the costa; paraphyses absent; annulus of 16 - 20 thickened cells. Sporangia long stalked, pale-brown or yellowish; spores with ribbed or tuberculate epispore, tetrahedral.

A family of 3 genera; 1 in Nagaland.

Onychium

Kaulf., Berlin Jahrb. Pharm. 21: 45. 1820; C. Chr., Ind. Fil. 468. 1906; Copel., Gen. Fil. 73. 1947.

Rhizome creeping, covered with scales, solenostelic. Stipes long, glabrous, not articulate to the rhizome. Fronds tripinnate or compound, glabrous; veins free. Sori elongate, along the margins; indusium parallel with the margins of the segments, linear, opposite, pressed down over the sori, the edge nearly reaching the midrib; sporangia long stalked, spores ribbed, tetrahedral.

About 7 species; 2 in Nagaland.

K E Y T O S P E C I E S

Rhizome creeping; sori about 5 mm long; sporangia pale-brown . . . . . japonicum

Rhizome semierect or ascending; sori more than 1 cm long; sporangia bright-yellow . . . . . siliculosum

Onychium japonicum (Thunb.) Kuntze, Bot. Zeit. 507.1848; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 459.1880; Bedd., Handb. Ferns Brit. India Suppl. 96. 1892; DeVol in Fl. Taiwan 1: 290. 1980;
Trichomanes japonicum Thunb., Fl. Jav. 340. 1784.

Rhizome erect or creeping, short, dictyostelic, covered by lanceolate scales; scales up to 1.3 cm long. Stipes tufted, 15 - 60 x 1.5 - 4 cm, stout, erect, stramineous, glabrous, straw-coloured or pale-brown, scaly at base; lamina 15 - 50 x 10 - 30 cm, ovate, quadripinnate, lower pinnae lanceolate, deltoid, subcoriaceous, glabrous; veins free. Sori elongate, submarginal on broad fertile pinnules, connected with veinlets; indusium pale, elliptic, margin entire, open inwardly; ripe capsules deep brown, projecting upwards; spores yellow, exine papillate.

Extremely common along roadsides and in open forests.

Fertile: July - December.

Distribution: CHINA, PAKISTAN, BURMA, KOREA, JAPAN, TAIWAN, PHILIPPINES, JAVA, INDIA - Himalayas, N.E. India.

Specimens examined: Jamir 6495 Kohima (Kohima dist., 1445 m); 6323 Morong forests (Tuensang dist. 1372 m); 6225, 6127 Changki (Mokokchung dist., 1000 m); 6055 Peren (Kohima dist., 1446 m).

Onychium siliculosum (Desv.) C. Chr., Ind. Fil. 20. 1906; DeVol in Fl. Taiwan 1: 58 (ed. 2). 1980.

Pteris siliculosa Desv., Berl. Mag. 5: 324. 1811.

Onychium auratum Kaulf., Enum. Fil. 144. 1824; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 458. 1880, (Plate 52).

Rhizome short, semierect, ascending, covered with brown, narrow scales; scales up to 0.7 cm long. Stipes 8 - 30 x 0.1 - 0.4 cm, glabrous, stout, erect, naked, pale-brown or straw-coloured; lamina 20 - 30 x 7 - 20 cm, ovate, quadri-pinnate at base; pinnae and lower primary pinnules stalked, linear; fertile pinnules 0.4 - 2.5 cm long, terminal pinnules much longer; pinnae caudate, usually trifid at the apex; rachis glabrous, brownish, both surfaces naked, membranous. Sori submarginal, continuous along both margins, connected with veinlets; sporangia pale brown; spores small, tetrahedral.

Common in jhummed areas and along roadsides in forests.

Fertile: January - October.

Distribution: CHINA, BURMA, TAIWAN, PHILIPPINES, MALAYA, NEW ZEALAND, POLYNESIA, INDIA - Himalayas, Meghalaya.

Specimens examined: Jamir 6237, 7985 Changki (Mokokchung dist., 1000 m); 6382 Mezenkong (Mokokchung dist., 1326 m).

17. PTERIDACEAE

Terrestrials. Rhizome short, creeping or erect, scaly, often hairy; vascular system of solenostelic or dictyostelic strands. Stipes erect to ascending, often tufted, with grooves on the adaxial surface; vascular strands usually simple and 'U'-shaped. Fronds simple pinnate to bipinnate or sometimes tripartite, the three branches subequal; herbaceous or coriaceous, glabrous or sometimes hairy; basal pair of pinnae or sometimes others often with a branch (sometimes more than one branch) near the base on the basiscopic side, rachis and costae grooved, often papillose in the grooves at the bases of pinnae, sometimes spiny at the bases of the costules and veins; veins all free (except in sori) or anastomosing without included veinlets. Sori linear, submarginal, continuous along the margin of the segments; true indusia absent, false indusia formed by the reflexed margins of segments covering the coenosori; paraphyses usually present; annulus of 12 - 34 thickened cells; spores tetrahedral, often bilateral, pale-blackish, the surface usually more or less rugose or papillose.

A family of about 7 - 8 genera; 1 in Nagaland.

Pteris

Linn., Sp. Pl. 2: 1076. 1753; C. Chr., Ind. Fil. 591. 1906; Copel., Gen. Fil. 60. 1947.

Characters of the family.

K E Y T O S P E C I E S

1a. Fronds dimorphic.

2a. Pinnae irregularly divided; sterile pinnae ovate to obovate, sharply serrate, terminal pinnae fertile, linear . . . . . ensiformis

2b. Pinnae uniformly divided or undivided; sterile pinnae linear, serrate or not; fertile pinnae on a different stipe or terminal leaflets fertile.

3a. Basal sterile leaflets usually 2-lobed . . . . . cretica

3b. Basal sterile leaves usually 3-lobed . . . . . pellucida

1b. Fronds monomorphic.

4a. Rachis trichotomously branched at base.

5a. Stipes and rachis dark-purplish, shining; pinnae not cut down up to costae; one pair of veins anastomosing above the sinus . . . . . wallichiana

5b. Stipes and rachis otherwise; pinnae cut down almost to costae; veins free throughout . . . longipes

4b. Rachis not trichotomously branched.

6a. Fronds unipinnate.

7a. Pinnae undivided, linear-lanceolate, villous . . . . . vittata

7b. Pinnae entire or subentire on the upper margin and pinnately divided on the lower margin, glabrous . . . . . semipinnata

6b. Fronds bipinnate or tripinnate.

8a. Basal pair of pinnae bipartite; pinnae 15 - 20 cm long; pinnules 0.5 - 1.4 cm long.

9a. Segments of pinnae distinctly cut down to the costae; veins free . . . . . quadriaurita

9b. Segments of pinnae not cut down to the costae; one pair of vein anastomosing above the sinus . . . . . biaurita

8b. Basal pair of pinnae not bipartite, but 2 or 3 lobed on the basiscopic side; pinnae 25 - 35 cm long; pinnules 2.5 - 4 cm long . . . . . longipinnula

Pteris biaurita Linn., Sp. Pl. 1076. 1753; Holttum, Fl. Malaya 2: 407. 1954; Wang-chueng Shiek in Fl. Taiwan 1: 293. 1980; Dhir, Ferns N.W. Himalayas 49. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 110. 1982. Campteria biaurita (Linn.) Hook. Gen. Fil. t. 65A 1841; Bedd., Handb. Ferns Brit. India Suppl. 116.1892.

Rhizome short, erect to ascending, with many crowded roots; scales about 0.5 cm long, dark-brown, linear-lanceolate. Stipes 25 - 60 x 0.2 - 0.5 cm, glabrous except at base, stramineous, adaxial surface grooved; lamina 30 - 60 x 20 - 30 cm, deeply bipinnatifid, glabrous, herbaceous; pinnae opposite or subopposite, 5 - 9 pairs; with a single apical pinna similar to other pinnae; lowest pinnae 15 - 28 x 2.5 - 5.5 cm; longest basiscopic pinnae forked once downwards at base, the other unbranched, sessile, oblique, slightly falcate, base cuneate, apex acuminate; each pinna comprising of 20 - 35 lobes on either side of the costa; each lobe up to 4 x 0.7 cm, oblong, falcate, tip rounded; fertile pinnae and lobes narrower and shorter than those of sterile ones; texture thin; veins forked, one pair of opposite sides uniting just above the sinus. Sori confluent along the margin of the sinus but not reaching the apex of the lobes; spores tetrahedral, dark-brown, not translucent.

Common along roadsides and slopes of hills in moist, shady places in secondary forests. Very variable fern.

Fertile: July - October.

Distribution: CHINA, MALAYA, TAIWAN, PHILIPPINES, BORNEO, JAVA, S. AFRICA, WEST INDIES, BRAZIL, AUSTRALIA, SRI LANKA, INDIA - Throughout Western ghats, Himalayas; North-east India.

Specimens examined: Jamir 6239, 6252 Mepongchuket (Mokokchung dist., 1300 m); 6525 Wokha (Wokha dist. 1314 m); 6206, 7969 Changki (Mokokchung dist., 1000 m); 6164 Pfutsero (Phek dist., 2134 m).

Pteris cretica Linn., Mant. 130. 1767; Bedd., Handb. Ferns Brit. India 196. 1883; Wang-chueng Shieh in Fl. Taiwan 1: 294. 1980; Dhir, Ferns N.W. Himalayas 47. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 110. 1982.

Rhizome creeping or ascending, clothed with small, dark-castaneous scales; scales up to 0.5 cm long. Stipes 10 - 40 x 0.2 - 0.4 cm, slender, stramineous, naked or with lanceolate, blackish-brown scales near the base; stipes of fertile fronds longer than those of sterile ones. Fronds dimorphic; sterile lamina 18 - 35 x 10 - 20 cm, simple pinnate, basiscopic 2 - 3 pairs of pinnae forked to the costae on posterior base; lateral pinnae 2 - 6 pairs, sessile, opposite or subopposite; pinnae 10 - 25 x 0.4 - 2 cm,

glabrous, margins sharply spinulose, serrate. Fertile fronds much longer than sterile ones; pinnae similar to those of sterile ones but somewhat narrower; rachis naked, texture coriaceous; veins simple, forked once. Sori confluent along the margins except at base and apex.

Common in open places and along roadsides; also common in forest plantations.

Fertile: January - November.

Distribution: AFRICA, TROPICAL AMERICA, SOUTH EUROPE, SRI LANKA, BURMA, INDIA - Madra, W. Bengal, Meghalaya.

Specimens examined: Jamir 7911, 7148 Kohima peak (Kohima dist., 1445 m); 7183 Mehuri (Tuensang dist., 1000 m).

✓ Pteris ensiformis Burm. f., Fl. Ind. 230. 1768; Bedd., Handb. Ferns Brit. India 107. 1883; Holttum, Fl. Malaya 2: 399. 1968; Wang-chueng Shiek in Fl. Taiwan 1: 295. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 110. 1982.

Rhizome short-creeping, scaly; scales linear, lanceolate, dark-brown, shining, entire, narrowly acuminate, stipes 5 - 30 x 0.1 - 0.3 cm, slender. Fronds distinctly dimorphous but sometimes some fronds fertile and partly sterile; sterile

lamina 10- 20 x 4 - 8 cm, simple pinnate, much shorter than fertile ones; apical lamina simple, often with 2 - 3 pairs of lobes; lateral pinnae 2 - 5 pairs; pinnae 3 - 12 cm long, deltoid with 1 - 3 pairs of pinnules or lobes and much elongated apex, the lowest basiscopic pinnule again often lobed; pinnules elliptic or oblong, rounded at apex, margins serrate. Fertile lamina about 15 - 35 cm long, bipinnate, glabrous, herbaceous, lamina longer than the stipes; terminal leaflet about 10 - 18 x 0.4 - 1 cm, lateral pinnae of 2 - 5 pairs, oblique or ascending, fertile pinnae similar in shape to that of sterile ones but much longer and narrower. Texture thin but firm, margins of both sterile and fertile leaflets crisped and cartilagineous; veins free, distinct on both surfaces, oblique, forked once or twice. Sori marginal, confluent, developing basi-petally; spores dark-brown, tetrahedral, covered with papillae.

Frequent, in open places and along roadsides and rocks crevices.

Fertile: July - November.

Distribution: S. CHINA, SRI LANKA, BURMA, BANGLADESH, MALAYA, S. JAPAN, TAIWAN, PHILIPPINES, POLYNESIA, AND TROPICAL AUSTRALIA, INDIA- South India, Himalayas, North-East India.

Specimens examined: Jamir 6564 Chumuketema (Kohima dist., 250 m).

Pteris longipes D. Don, Prodr. Fl. Nepal 15. 1825; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 468. 1880; Wang-chueng Shiek in Bot. Mag. Tokyo 79: 291. 1966 et in Fl. Taiwan 1: 297. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 110. 1982. P. pellucens Agardh, Rec. Pterid. 43, 1839; Bedd., Handb. Ferns Brit. India 115. 1833; et Ferns South India Pl. 32. 1863.

Rhizome short-ascending, apex densely clothed with linear-lanceolate, dark-brown, hair-pointed scales; scales up to 0.7 cm long. Stipes 20 - 60 x 0.2 - 0.6 cm, tufted, dark, purplish-brown, glabrous except at base; lamina 20 - 50 x 10 - 30 cm, pedate, tripartite, consisting of a subbi-pinnate middle portion and a pair of basal pinnae; basal pinnae up to 30 x 15 cm or more; secondary pinnae 15 x 2.5 cm, petiolate to sessile, opposite to subopposite, pinnatifid up to or nearly reaching the costae; apex long, caudate; segments 1.2 x 0.5 cm, oblong-obtuse, conspicuously serrated at the sterile portion of the apex; costae and costules scaly beneath; veins free, forked; rachis glabrous, dichotomously forked at base. Sori confluent, marginal, never extending to the base and apex of segments; indusium finely serrate on their margins.

Frequent, in shady places of either open or natural dense forests; sometimes along the canals and ditches.

Fertile: February - December.

Distribution: SRILANKA, BURMA, BHUTAN, TAIWAN, PHILIPPIN S, JAVA, NEW ZEALAND, INDIA - Western ghats, Sikkim, Kashmir and North-east India.

Specimens examined: Jamir 7906 Kohima (Kohima dist., 1445 m); 6301 Shamator village (Tuensang dist., 1692 m); 6525 Wokha (Wokha dist., 1314 m).

✓ Pteris longipinnula Wall. ex Agardh, Rec. 19. 1839; Hook., Sp. Fil. 2: 179. t. 134. 1858; Clarke in Trans. Linn. Soc. ser. 2 (Bot.) 1: 467. 1880; Bedd., Handb. Ferns Brit. India 112. 1883; Holttum, Fl. Malaya 2: 404. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 110. 1982.

Rhizome erect, densely clothed with linear, reddish-brown scales; margin of scales densely ciliate. Stipes up to 50 cm long or more, erect, slender, ridged, glabrous, except at base, green in living, pale-dark to purplish when dry; lamina up to 60 x 35 cm, bipinnatifid, with an apical pinna and 3 - 8 pairs of lateral pinnae; the lowest pinnae simple or branched near the base on the lower side; pinnae 20 - 35 x 4 - 7 cm, deeply pinnatifid, opposite or subopposite, lanceolate, base cuneate, apex caudate, about 2 - 8 x 0.3 - 0.8 cm at base; lobes gradually reduced towards apex, edges thickened and undulate; largest lobed about 2 - 3 x 0.5 - 1 cm, entire,

blunt, falcate, not distant; rachis, costae and costules glabrous, spinules present on upper surface; veins free or once forked, Sori confluent, marginal, continuous almost from base to the apex of the lobes; spores dark-brown, triangular to 'T'-shaped.

Not common; in moist shady places and also near ditches.

Fertile: October - February.

Distribution: MALAYA, BANGLADESH, INDIA - Sikkim, Meghalaya, Assam, South India.

Specimens examined: Jamir 7005 Changki village (Mokokchung dist., 1000 m); 6510 Wokha (Wokha dist., 1314 m).

✓ Pteris pellucida Presl, Rel. Haenk, 1; 55. 1825; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 462. 1880; Bedd., Ferns South India Pl. 38. 1863.

(Plate 55)

Rhizome short, creeping, clothed with short, narrow, darkish scales. Stipes 20 - 40 cm long, erect, glabrous; lamina 20 - 35 x 10 - 25 cm, often simple, ovate-lanceolate, pinnate; pinnae variable in numbers, sometimes 3 - 13 pinnae or 1 only, 15 - 30 x 1.5 - 3 cm, all simple or the lowest pinnatifid, entire or nearly serrated at acuminate apex; the margins of sterile pinnae entire, undulate, crisped or crenulate; the upper pinnae sometimes decurrent, rachis

naked; texture coriaceous, surfaces bright green, glossy; veins fine, close, purple, forked at right angles from the midrib; indusium marginal, pale, membranous. Sori usually all along the margins except at apex; spores tetrahedral.

Frequent; both in open and shady places.

Fertile: July - October.

Distribution: MALAYA, GUINEA, INDIA - South India Anamallay forests up to 610 - 1220 m.

Specimens examined: Jamir 6668, 6667 Tejit (Mon dist., 200 m).

√Pteris quadriaurita Retz., Obs. Bot. 6: 38. 1791; Bedd., Handb. Ferns Brit. India Suppl. 110. 1892; Iwatsuki, in Fl. East. Himal. (3 Rep.). 178. 1975; Dhir, Ferns N.W. Himalayas 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 117. 1982.

(Plate 56)

Rhizome short, erect or suberect, apex densely clothed with scales; scales linear, dark-brown, hair pointed, about 1 cm long. Stipes 20 - 55 x 0.2 - 0.6 cm, erect, glabrous or scabrous, pale-purplish; lamina 25 - 45 x 15 - 30 cm, variable in size, bipinnate, glabrous, lanceolate or ovate-lanceolate, with 12 - 23 pairs of subopposite,

coriaceous, lateral pinnae; lateral pinnae 10 - 20 x 2 - 4 cm, pinnatifid, oblong, oblong acuminate or caudately deeply cut down into many pinnules or segments, nearly reaching to the costae; pinnules oblong, entire or serrate, apex obtuse or acute; the lowest pair ofpinnae (or rarely 2 lowest pair of pinnae) bipartite, often bearing several pinnae on the lower side; upper surface of costae and costules with spinules ; veins free, usually forked once, raised on the ventral surface. Sori blackish-brown, generally partial on the margins of the segments, rarely up to the apex.

Very common throughout the state, especially in jhum-fallows, but nowhere abundant.

Fertile: July - December.

Distribution: Sri Lanka, Malaya, India - Throughout India, from the plains up to 2,439 m elevations.

Specimens examined: Jamir 6383 Kohima Peak (Kohima dist., 1443 m); 6438 Zenheboto (Zenhebota dist., 2043 m); 6223 Changki (Mokokchung dist., 1000 m); 6343 Morong forest Sangpore (Tuensang dist., 2136 m); 7169 Helipong forests (Tuensang dist., 1372 m).

Pteris semipinnata Linn., Sp. Pl. 1534. 1753; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 464. 1880; Bedd., Handb. Ferns Brit. India 109. 1883; Holttum, Fl. Malaya 2: 298, (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 111. 1982. (Plate 56A).

Rhizome short-ascending, clothed with very narrow, entire shining, dark-brown scales; scales about 0.5 cm long. Stipes tufted, 20 - 50 x 0.2 - 0.4 cm, dark-purplish, polished, slender; lamina 25 - 50 x 10 - 30 cm, semipipinnate, glabrous, papyraceous; apical pinnae about 8 - 15 cm long, deltoid in outline, with about 6 - 12 pairs of falcate lobes, near to the rachis; lobes about 4 - 7 x 0.4 - 0.8 cm, bases more or less dilated, tapering gradually to acute apex; other lateral pinnae comprising of 4 - 8 pairs, subopposite, nearly sessile, acroscopically falcate, upper margins entire, finely serrate, deeply lobed on the lower margin; lowest pinnae 8 - 18 cm long, with 3 - 9 falcate lobes; the longest lobe about 5 cm long; sterile pinnae finely toothed or serrate at margins; texture thin; rachis castaneous, purplish-dark, shining, glabrous, grooved above; veins free, fine, forked once, oblique, usually slightly raised on both surfaces; midrib and costae of lobes grooved on the upper surface; fertile pinnae similar to those of sterile in shape, entire. Sori linear, continuous along the margins of lobes, except quite near the apices; indusia reaching the sinus; spores triangular

to oval, pale-brown, surface granular.

Frequent, but no where abundant; mostly grows on humus covered soils in secondary forests. Also common in jhum fallows.

Fertile: February - October.

Distribution: CHINA, MALAYA, JAPAN, TAIWAN, PHILIPPINES, BORNEO, S.E. ASIA, BANGLADESH, BURMA, INDIA - Assam, Meghalaya and Travancore hills.

Specimens examined: Jamir 6175, 7102, 6181, 7043 Changki village (Mokokchung dist., 1000 m); 6647 Mon (Mon dist., 898 m).

Pteris vittata Linn., Sp. Pl. 1074. 1753; Holttum, Fl. Malaya 2: 396. 1968; Iwatsuki in Fl. East. Himal. (3 Rep.) 178. 1975; Wang-chueng Shiek, in Fl. Taiwan 1: 300 (ed. 2). 1980; Dhir, Ferns N.W. Himalayas 46. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 111. 1982.

P. longifolia Ogata, Icon. Fil. Jap. 3: t, 146. 1830 (non. Linn.); Bedd., Ferns South India Pl. 33. 1869; et Ferns Brit. India 106, Pl. 55. 1883.

(Plate 57)

Rhizome short, erect to suberect, densely clothed with long, narrow, thin, entire, pale-brown, scales; scales up

to 0.5 cm long. Stipes 5 - 40 cm long, or more, stout, erect, pale, clothed with silky, pale-brown, linear scales throughout; lamina 25 - 90 x 0.2 - 0.5 cm or more, simple pinnate, with a single, elongate, linear, terminal pinnae like the lateral ones; pinnae numberous, 1 - 3.5 cm apart, middle ones longest, basal ones gradually reduced, upper ones only slightly reduced; all pinnae sessile, oblique, serrulate; largest pinnae 5 - 20 x 0.5 - 1 cm, base cuneate to cordate, somewhat dilated at acroscopic side; serrulate apex acuminate; a few pairs of basal pinnae reduced to auricle-like appendages; sterile pinnae sharply and shortly toothed throughout the margins; texture thin, herbaceous; both surfaces naked; rachis naked or slightly scaly, specially when young; costae grooved; veins fine, close, free, usually forked once near the costa, not anastomosing except as joint by the sorus, distinct on both surfaces; indusium membranous, yellowish-brown. Sori continuous along the margins, except at base and apex; spores round, brownish.

Very common along road cuttings and rock crevices, both in plains and hilly areas. This is one of the commonest of Pteris spp. in Nagaland.

Fertile: July - February.

Distribution: BURMA, TAIWAN, MALAYA, INDIA - South India, Meghalaya, Assam.

Specimens examined: Jamir 6222, 7052 Changki (Mokokchung dist., 1000 m); 6131 Phek (Phek dist., 2000 m); 6557, 6034 Dimapur (Kohima dist., 100 m).

Pteris wallichiana J.G. Agardh., Rec. Spec. gen. Pterid. 69. 1839; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.). 1: 469. 1880; Iwatsuki in Fl. East. Himal. (3 Rep.) 78. 1975; Wang-chueng Shiek in Fl. Taiwan 1: 301. 1980; Dhir, Ferns. N. W. Himalayas 49. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 111. 1982.

Campteria wallichiana Bedd., Ferns Brit. India t. 25, 217. 1865.

(Plate 58)

Rhizome short, ascending. Stipes 50 - 90 x 1 - 2 cm, erect, glabrous, glossay, slender, dark-purplish; lamina 30 - 90 cm long, irregularly dichotomously branched, tri to quadripinnatifid, broad, pedate; rachis trichotomously forked at base (3-partite), bearing two lateral pinnae and one elongated, terminal pinna; lateral branches 20 - 60 x 10 - 20 cm, bi to triparttite at their basioscopic side; terminal branch 30 - 70 x 15 - 30 cm, or more, glabrous above, short hairy beneath; pinnae numerous, the largest pinnae 10 - 25 x 2 - 4 cm, sessile, linear, lanceolate-acuminate, deeply pinnatifid; segments 1 - 2 x 0.3 - 0.5 cm, linear-lanceolate, obtuse; sterile segments serrulate.

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 portion of the lobes.

Extremely common in moist and shady places near rivers and streams at higher elevations.

Fertile: July - December.

Distribution: CHINA, JAPAN, TAIWAN, PHILIPPINES, MALAYA, JAVA, BHUTAN, INDIA - Himalayas up to 915 - 2439 m, Meghalaya.

Specimens examined: Jamir 6327, 6345 Morong forest, Sangpore (Tuensang dist., 2136 m); 6228, 6092, 7905 Kohima peak (Kohima dist., 1445 m); 6229 Pfotsero (Phek dist., 2134 m); 6430 Zenheboto (Zenheboto dist., 1875.m).

18. ADIANTACEAE

Terrestrials. Rhizome long-creeping or short and erect to ascending, solenostelic, covered with narrow brown or blackish scales. Stipes not jointed to rhizome, slender, scaly at base, dark, polished; midrib and rachis grooved on the upper surface. Fronds simple pinnate to tripinnate, often dichotomously branched; leaflets fan-shaped, nearly entire, more or less deeply lobed, usually toothed at the

margin, mostly herbaceous, often coriaceous, glabrous, rarely hairy, glaucous; veins free, rarely anastomosing, simple. Sori dorsal or marginal, superficial, borne along the veins on the inner face of reflexed marginal flaps or outgrowths serving as indusia; sporangia large, stalked, attached along the veins; paraphyses absent; annulus of 10- 15 thickened cells, incomplete; spores tetrahedral, smooth, without perispore.

Only genus of the family - Adiantum Linn.

Adiantum

Linn., Sp. Pl. 2: 1094. 1753; C. Chr., Ind. Fil. 22. 1906; Copel., Gen. Fil. 78. 1947.

Terrestrials. Rhizome long-creeping or short, erect or ascending, solenostelic, covered by narrow, brown scales. Stipes not articulate to rhizome, slender, dark, polished, rarely hairy; lamina simple pinnate to tripinnate, often dichotomous; leaflets subentire, more or less deeply lobed, usually toothed at margin, glabrous or hairy, glaucous; veins free, forked. Sori dorsal or marginal covered with a marginal, reflexed indusium; sporangia borne on veins or extending to inter spaces on inner face of reflexed portions of lamina; annulus incomplete; spores tetrahedral or bilateral, smooth.

A large genus with about 200 species throughout the warmer parts of the world; 3 species in Nagaland.

K E Y T O S P E C I E S

1a. Fronds bipinnate to tripinnate . . . **capillus-veneris**

1b. Fronds simple pinnate.

2a. Rachis and pinnae glabrous . . . . **philippense**

2b. Rachis and pinnae hairy . . . . **caudatum**

Adiantum capillus-veneris Linn., Sp. Pl. 1558. 1753; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 453. 1880; Bedd., Handb. Ferns Brit. India 84. 1833; Holttum Fl. Malaya 2: 600. 1968; Iwatsuki in Fl. East. Himal. (3 Rep.) 172. 1975; Wang-chueng Shieh in Fl. Taiwan 1: 303. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 141. 1982. (Plate 58A).

Rhizome short creeping, densely clothed with brown, narrow, entire scales; scales about 0.2 cm long. Stipes 5 - 25 x 0.1 - 0.2 cm, blackish, polished, glabrous, shining, suberect, rather slender; lamina 12 - 25 x 5 - 15 cm, shortly stalked, glabrous, cuneate at base, light green; the outer edge rounded, deeply 4 - 5-lobed; lobes crenate; sterile lobes with more or less rounded, finely toothed edges. Sori elliptic or linear, placed in roundish sinuses of the crenations; sporangia globose, small; spores tetra-

hedral, yellowish, hyaline.

Not common; in moist areas near streams and road cuttings and also in moist rock crevices.

Fertile: July.

Distribution: EUROPE, AFRICA, AMERICA, AUSTRALIA, MALAYA, TAIWAN, CHINA, PHILIPPINES, INDIA - South India, Madras Presiderncy, North India. Himalayas, N.E. India.

Specimens examined: Jamir 6551 Chumuketema (Kohima dist., 250 m).

Adiantum caudatum Linn., Mant. Pl. 308. 1771; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 453. 1880; Bedd., Handb. Ferns Brit. India 83. 1833; Holttum, Fl. Malaya 2: 599. 1968; Wang-Chueng Shieh in Fl. Taiwan 1: 303. 1980.

(Plate 59)

Rhizome short, erect, densely scaly; scales up to 0.5 cm long, narrow, dark-brown with slightly pale edges. Stipes 4 - 10 cm long, dark-purple, densely covered with dark reddish, stiff, spreading hairs; rachis similar to stipe, short and densely hairy on the uppersurface, sparsely hairy on the lower surface; lamina 12 - 40 cm long, simple pinnate with many subsessile pinnae, apex acuminate, usually prolonging into a whip-like, rooting stolon, both surfaces covered by hairs; upper pinnae gradually smaller;

largest pinnae in the middle portion of lamina, about 0.8- 2 cm long, pectinate, dimidiate, the lower line straight, horizontal, the upper rounded, more or less cut, deeply and repeatedly, lobes 4 - 5, apices truncate; sterile pinnae shortly toothed; texture thin, coriaceous; veins prominent. Sori on the apices of the lobes, roundish-oblong; indusia cordate, round, entire, densely hispidulous.

Common along road cuttings in moist areas and also in slopes of hills; at certain places abundant.
Fertile: May-October.

Distribution: AFRICA, CHINA, SRI LANKA, BURMA, MALAYA PENNINSULA, TAIWAN, PHILIPPENES, NEW GUINEA, JAVA, INDIA - Throughout India.

Specimens examined: Jamir 6549 Chumuketema (Kohima dist., 250 m); 7194 Meluri (Phek dist., 1280 m).

Adiantum philippense Linn., Sp. Pl. 2: 1094. 1753; Holttum, Fl. Malaya 2: 598. 1968; Iwatsuki in Fl. East. Himal. (3 Rep.) 172. 1975; Wang-chueng Shieh in Fl. Taiwan 1: 306 (ed. 2). 1980.

A. lanulatum Burm. f. Fl. Ind. 235. 1768; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.). 1: 452. 1880; Bedd., Handb. Ferns Brit. India 82. 1833.

(Plate 60)

Rhizome short, erect or suberect, scaly; scales about 0.3 cm long, narrow, dark, black, polished, grooved, shining, glabrous; lamina 7 - 30 cm long, simple pinnate, bearing 7 - 12 alternate pinnae on each side of the rachis; leaflets borne on slender, blackish, stalk; the lowest longest, about 1 - 1.5 cm long; pinnae up to 1 - 5 cm long, sub-arbicular to obliquely oblong-ovate; upper margin of pinnae lobed, truncate, cuneate; texture thin, herbaceous; veins slightly raised, fine. Sori linear, confluent or not, arranged along the edges of lobes; indusia coriaceous, entire, brownish; sporangia stalked; spores tetrahedral, smooth.

Common along river and stream banks and in moist shady slopes in forests. One of the commonest of Adiantum spp. in Nagaland. The apex of the fronds usually rooting.

Fertile: July- October.

Distribution: Tropics and subtropics of the world (MALAYA, SRI LANKA, BURMA). INDIA - South India, Nilgiris; throughout Northern India in most places.

Specimens examined: Jamir 6562 Chumuketema (Kohima dist., 250 m); 4400 Changki (Mokokchung dist., 1000 m); 6074 Peren (Kohima dist., 1446 m); 6697 Tejit (Mon dist., 100 m).

19. HEMIONITIDACEAE

Terrestrials. Rhizome short or long creeping, clothed with narrow, brown scales; vascular bundles dictyostelic or rarely solenostelic. Stipes erect or suberect, glabrous, polished, dark-brown, scaly at base. Fronds large, simple pinnate or bipinnate, leaflets entire or serrulate, firm or herbaceous, often coriaceous, usually glabrous; veins free, forked once, twice or rarely anastomosing, without included free veinlets, ending in hydathodes. Sori along the veins on the lower surface of fertile leaflets, exindusiate; paraphyses absent or sometimes small; annulus of 13 - 24 thickened cells; spores tetrahedral or rarely bilateral, dark, smooth without perispore; exine reticulate, spinulose.

Genera about 22; 2 in Nagaland.

K E Y T O G E N E R A

Lower surface of fronds covered by white or yellow powder . . . . Pityrogramma

Lower surface not covered by such powder . . . . . Coniogramme

Coniogramme

Fee, Gen. Fil. 167. 1852 (nom. cons.); C. Chr., Ind. Fil. 185. 1906; Copel., Gen. Fil. 63. 1947.

Terrestrials. Rhizome creeping, often short, clothed with narrow, brown scales. Fronds simple pinnate or bipinnate; leaflets entire or serrulate, herbaceous or firm, glabrous; veins free and forked once or twice. Sori continuous along the veins, exindusiate; paraphyses small; annulus of 13 - 22 thickened cells; spores tetrahedral, rarely bilateral, smooth, perispore absent.

A genus with about 20 species confined mainly to Africa, Polynesia, Japan and Mexico; 6 species in Nagaland.

K E Y T O S P E C I E S

1a. Fronds pinnate.

2a. Pinnae serrate or serrulate; lower most pinna 2-lobed . . . purpurea

2b. Pinnae entire or the margins more or less wavy; lower most pinna simple.

3a. Plants below 70 cm; pinnae 15 - 20 x 3 - 5 cm . . . . . falcata

3b. Plants and pinnae more than above.

4a. Pinnae ovate-oblong-lanceolate; round or cuneate at base . . . . . fraxinea

4b. Pinnae broadly elliptic-lanceolate, cordate or obliquely rotundo-truncate at base . . . . . pitelotii

1b. Fronds bipinnate.

5a. Only lowermost pinnae pinnate; pinnules entire . . . . . fraxinea

5b. Fronds binnate throughout; pinnules serrate or serrulate.

6a. Basal pinnae with 1 - 5 pairs of pinnules . . . . . caudata

6b. Basal pinnae with 7 - 12 pairs of pinnules . . . . . procera

Coniogramme caudata (Wall. ex Ettingsch) Ching in C. Chr., Ind. Fil. Suppl. 111: 56. 1934; Icon. Fil. Sin. 4: t. 167. 1937; Ito, Fl. East. Himalayas 460. 1966; Dixit & Das in Proc. Ind. Acad. Sci. 88 (4): 265. 1979; Dhir, Ferns N.W. Himalayas 44. 1981.

Grammitis caudata Wall. (List No. 4, 1828 nom. nud.) ex Ettingsch, Prankr. 57. t. 37, f. 7, t. 38. 1865.

Rhizome thick, wide-creeping, clothed with many lanceolate, dark-brown scales; scales up to 0.5 x 0.1 cm; roots brownish, wide-spreading. Stipes 20 - 55 x 15 - 30 cm, simple pinnate throughout or bifid to bipinnate at basal region; basal pinnae 1 - 2 cm long, stalked; upper ones subsessile or nearly decurrent; pinnae 12 - 18 x 2 - 3.7 cm, oblanceolate, gradually tapering to a cuneate base, caudate at apex, acumen up to 2 cm long, margins sharply serrate to apinulose; midrib shining, raised on the lower surface, lower surface pubescent, upper surface glabrous; texture thin to thick; veins forked at base, often again forked at the middle or towards apex, ending in hydathodes, sporangia arranged along the veins, extending from costa to nearly reaching margins; spores trilete, yellowish-brown; exine verrucoid.

Not common; in evergreen forests and also in slopes of hills.

Fertile: December - January.

Distribution: NEPAL, CHINA, INDIA - Eastern and Western Himalayas.

Specimens examined: Jamir 6464 Kohima (Kohima dist., 1445 m), The abruptly caudate, pubescent pinnae, which are cuneate at base makes this species quite distinct.

Coniogramme falcata (D. Don) Salom., Nomenclatur, 139, 1888; Hieron., Hedw. 57: 325. 1916; Dixit & Das, J. Indian Bot. Soc. 56 (3): 254. 1977;

Diplazium falcatum D. Don, Prodr. Nepal. 13. 1825.

Gymnogramme falcata (D.Don) J.Smith in J. Bot. 4: 51. 1942.

Rhizome thick, creeping, clothed with many dull-brown, ovate-lanceolate, scales; scales up to 0.6 x 0.1 cm. Stipes 20 - 30 x 0.4 - 0.8 cm, erect, pale-brown, glabrous except at base; lamina up to 55 x 28 cm, light green, simple pinnate, imparipinnate; pinnae 12 - 25 x 3 - 6 cm, ovate to oblong-lanceolate, stalked, cuneate at base or slightly oblique, caudate at apex, often falcate, margin entire to repand with a narrow cartilaginous band of sclerotic cells, alternate to subopposite; texture thin but frim; veins simple, forked once or more, ending in hydathodes. Sori arranged along the veins, extending from costa to nearly reaching margins; spores yellow, smooth.

Frequent in natural forests and also on slopes of hills near streams and rivers.

Fertile: November - January.

Distribution: NEPAL, INDIA - Eastern and Central Himalayas: Darjeeling to Karseong 2000 m; Sikkim to Tumlong 1800 m; Arunachal Pradesh to Kameng dist;;Nagaland.

Specimens examined: Prain s.n. (CAL - 24181), Kohima.

Coniogramme fraxinea (D. Don) Diels, in Engl. & Prantl, nat. Pflanzenfam. 1(4): 262. 1899; C. Chr., Ind. Fil. 185. 1906; Dixit & Das in J. Ind. Bot. Soc. 56: 255. 1977; et in Proc. Ind. Acad. Sc. 88B(4): 258. 1979; Holttum, Fl. Malaya 2: 589. 1968; Dhir Ferns N.W. Himalayas 43. 1980; Wang-chuen Shieh in Fl. Taiwan 1: 310. (ed.2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 145. 1982.
Diplazium fraxinum D. Don, Prodr. Fl. Nepal 12. 1825.
Syngramme fraxinea (D. Don) Bedd., Handb. Ferns Brit. India 386. 1883 (pro parte).
Gymnogramme fraxinea (D. Don) Bedd., Ferns Brit. India Suppl. 24. 1876.

(Plate 61)

Rhizome long-creeping, rather stout, thick, clothed with narrow lanceolate, dull-brown scales; scales up to 0.6 cm long. Stipes up to 70 x 1.3 cm or more, erect, naked, glabrous, light-brown; rachis glabrous, pale-brown, grooved on the upper surface; lamina up to 70 x 40 cm, ovate or oblong-ovate, bifid to bipinnate at base, rest simple pinnate with 3 - 8 pairs of pinnae; largest pinnae up to 30 x 6.5 cm; pinnae or pinnules narrowly elliptical, entire, base cuneate, apex shortly caudate-acuminate, the narrow tip 1 - 2.5 cm long; upper ones sessile to decurrent;

texture thin to thick, firm, herbaceous, glabrous on both surfaces or little pilose beneath; sori extending along the veins; spores yellow, trilete; exine granulose.

Fertile: May - October.

Distribution: CHINA, PAKISTAN, JAVA, MALAYA, TAIWAN, PHILIPPINES, SR LANKA, JAPAN, NEPAL, INDIA - Himalayas, Sikkim, Manipur, West Bengal.

Specimens examined: Jamir 6501 Wokha (Wokha dist., 1314 m); 7161 Changki (Mokokchung dist., 1000 m).

Coniogramme pitelotii Tard.-Blot. Bull. Mus. Paris 11, 5: 334. 1933; C. Chr., Ind. Fil. Suppl. 11, 57. 1934; Dixit & Das in J. Ind. Bot. Soc. 56 (3): 257. 1977; et in Proc. Ind. Acad. Sc. 88 (4): 261. 1979.

C. subcordata Ching, Bull. Fan. Mem. Inst. 2: 213. 1931 (non. Copel., 1910).

Rhizome creeping, stout; stipes up to 45 cm long, rather stout, erect, glabrous or pale stramineous; rachis glabrous, pale-brown; lamina up to 55 x 25 cm, the lowermost pinna bifid, the rest above simple pinnate; pinnae 5 - 8 pairs, alternate, largest pinna up to 20 x 4 cm or more, broadly elliptic-lanceolate, variable at base, lowermost pinnae somewhat cordate, the middle ones roundly

truncate, and the upper ones rather roundly cuneate or slightly adnate (the uppermost pair), long acuminate at apex with the acumen 1 - 3 cm long, margins entire; texture papyraceous; glabrous on both surfaces of lamina; veins fine, close, oblique to costae, simple, forked once or twice, ending in rather large, clavate hydathodes slightly away from the margin. Sori linear, close, extending from costae almost or half way to margins, along the veins; spores yellowish-brown.

Rare; in moist and shady forest floors; also grows near streamlets and river banks.

Fertile: December.

Distribution: CHINA, YUNNAN, TONKIN, INDIA - Meghalaya.

Specimens examined: Jamir 6449 Zenheboto (Zenheboto dist., 1875 m); Dixit & Das (loc. cit. 1971) say 'Rhizome not seen'. The rhizome of this species is clearly creeping.

Coniogramme procera Wall. ex Fee, Mem. 22, 1865; Hieron., Hedw. 57: 317. 1916; Dixit & Das in Proc. Ind. Acad. Sci. 88B (4): 266. 1979; Wang-chueng Shieg in Fl. Taiwan 1: 311 (ed.2). 1980; Gymnogramme javanica sensu Hook. Sp. Fil. 5: 145. 1864 (pro parte, non. Blume, 1828). Syngramme fraxinea (D.Don) Bedd., Handb. Ferns Brit. India 386. 1883 (pro parte)

(Plate 62)

Rhizome thick, shortly to wide creeping, erect, clothed with many, dark-brown scales; scales up to 0.7 x 0.2 cm, linear; roots wiry, long spreading; vascular cylinder dictyostelic. Stipes 30 - 60 x 1 - 2 cm, erect, pale-brown, stramineous, sparsely caducous scaly; lamina 25 - 60 x 30 - 50 cm, bipinnate (rarely tripinnatifid), apical portion pinnate; pinnae 12 - 40 x 5 - 15 cm, ovate to lanceolate; each pinna again comprising of 6 - 15 pairs of lateral pinnules, alternate to subopposite; pinnules 3 - 8 x 1 - 2 cm, ovate-lanceolate, adnate, broadly cuneate at base or rarely truncate; caudate at apex, crenate or serrulate except at very base, acumen with larger serrations, about 1 - 2 cm long; texture thin, herbaceous; veins free or once forked, ending in hydathodes near the marginal serrations. Sori linear, forked, extending from costa to little over half way to the margin; spores deep yellow.

Not common; in natural forests along streams and also in shallow waters in forests.

Fertile: October - November.

Distribution: CHINA (YUNNAN), TAIWAN, NEPAL, THAILAND, FORMOSA, INDIA - Himalayas, Darjeeling, Arunachal Pradesh, Assam, Manipur, Nagaland.

Specimens examined: Jamir 6346, 6337 Morong forests (Tuensand dist., 1000 m); This is a large sized Coniogramme, in Nagaland.

Coniogramme purpurea Dixit & Das, in Proc. Ind. Acad. Sci. 88B(II.No.4). 264. 1979.

Terrestrials, Rhizome wide creeping, not stout, apex covered with many, shining, dark-brown scales. Stipes 15 - 30 cm or more long, erect, pale-yellowish or dark-purplish, shining; rachis glabrous, yellowish-brown; lamina up to 35 x 25 cm, simple pinnate throughout except lowermost pinnae which is bifid; pinnae up to 6 or more pairs, alternate or uppermost 1 or 2 pairs adnate; largest pinnae up to 16 x 3.5 cm, ovate-lanceolate, rounded to truncate or slightly oblique at base, broadest somewhat near middle, gradually narrowed into shortly caudate apex (acumen 1 -2 cm long), margin usually dentate or serrate except at very near the base; texture thin but firm; glabrous on both surfaces of lamina; midrib raised on lower surface, yellowish-green when dry; veins forked once or twice, ending in hydathodes, the anterior end of which extend into the marginal serrations. Sori oblique to costa, extending nearly or half way to the margins along lateral veins; spores deep-yellow.

Frequent in dense forests in moist, shady places near water courses.

Fertile: December.

Distribution: INDIA - Darjeeling.

Specimens examined: Jamir 7248 Japvo (Kohima dist., 2400 m); T

This species has been described by Dixit & Das (loc. cit.) as a new species from Darjeeling and the present collection from Nagaland indicates its eastwards extension.

Pityrogramma

Linn, Handb. d. Gewachse 3: 19. 1833; C. Chr., Ind. Fil. Suppl. 137. 1913; Copel., Gen. Fil. 75. 1947.

Terrestrials. Rhizome short, erect or ascending, clothed with narrow, entire, thin, dark-brown scales, dictyostelic. Stipes polished, dark to purplish; scaly at base, glabrous above; lamina 2 - 3 pinnate, ovate, herbaceous to sub-coriaceous, lower surface of leaflets covered with a white to yellow waxy powder. Veins free. Sori borne along the whole length of the veins on the lower surface of the fertile leaflets; exindusiate; paraphyses absent; margin of lamina not reflexed; annulus of 12-24 thickened cells; spores tetrahedral, dark, with irregularly reticulate-ribbed, epispore.

A genus with about 40 species; 1 in Nagaland.

Pityrogramma calomelanos (Linn.) Link, Fil. Hort. Berol. 61, 1841; Clarke in Trans. Linn.Soc. Ser 2 (Bot.) 1: 461. 1880; Holttum, Fl. Malaya 2: 593. 1968; Wang-chueng Shieg in Fl. Taiwan 1: 315. (ed.2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 146.1982.
Acrostichum calomelanos Linn., Sp. Pl. 2: 1072.1753.
Pteris calomelanos (Linn.) Sw. in Schrard. J.1800, 2: 70. 1802; Bedd., Ferns Brit. India t. 22. 1865.
(Plate 63)

Rhizome short, erect to ascending, clothed with narrow, entire, thin, dark-brown scales; scales up to 0.6 cm long; vascular strands dictyostelic. Stipes tufted, 10 - 35 x 0.2 - 0.5 cm, bipinnate, the pinnae in the lower half of the frond more or less equal, gradually shortened towards apex, covered with a white waxy powdery substance throughout the lower surface; pinnae up to 15 x 5 cm at base, shortly stalked, bipinnatifid at base, deeply lobed, acuminate; largest pinnules up to 2 cm long, oblique, narrowly deltoid, deeply lobed at base, acute at apex; lobes oblique, elliptic, toothed; texture thin but firm; veins free, sporangia borne on veins throughout the lower surface; spores tetrahedral.

Common in open places, as well as along the road cuttings on hills. Frequently on moss covered rocks.

Fertile: October.

Distribution: TROPICAL AMERICA, TAIWAN, MALAYA, AFRICA, INDIA - Meghalaya, N.W. Himalayas.

Specimens examined: Jamir 6325, 7054 Mon (Mon dist., 898 m); 6199 Changki (Mokokchung dist., 1000 m).

20. VITTARIACEAE

Epiphytes, rarely terrestrials. Rhizomes short, creeping to ascending, often branched, covered by brown, pointed, narrow, clathrate scales; roots densely covered by brown, soft hairs, Stipes short, stipitate or sessile, containing two vascular bundles. Fronds tufted on rhizome, simple, entire, glabrous, coriaceous, often forked at apex, with or without distinct midribs; veinlets reticulate, areoles without included veinlets; epidermis with long thick-walled sclerids. Sporangia borne along the marginal or dichotomously forked veins, superficially spread over all the veins or restricted to a marginal vein,often sunk in grooves in the lamina; paraphyses yellow or brown, numerous, filiform or club-shaped, simple or branched; annulus of 12 - 17 indurated cells; spores trilete or monolete, perineless; exine smooth.

A family of 10 genera; 2 in Nagaland.

K E Y T O G E N E R A

Sori linear, along the margin in grooves;
veins forming one series of areoles,
anastomosing only near the margin . . . . . Vittaria
Sori all along the veins; veins
copiously anastomosing throughout
the surface . . . . . Antrophyum

Vittaria

J. Smith, Mem. Acad. Turin 5: 413, t. 9. 1793; C. Chr., Ind. Fil. 653. 1906; Copel., Gen. Fil. 225. 1947.

Grass-like ferns; epiphytes or often on mossy rocks. Rhizome short-creeping, slender, dictyostelic, roots covered with borwn hairs; scales brownish-black, clathrate, narrow attenuate. Stipes articulate to rhizome, often distant, with two vascular bundles. Fronds simple, narrowly linear, entire, suberect or pendent, sessile or stipitate; texture coriaceous or fleshy, firm, herbaceous; costa usually distinct; veins dichotomously forked, areoles without included veinlets. Sori linear, along submarginal veins or borne in an apparently marginal groove; paraphyses branched, ending in clavate, obconical cells, yellowish-brown or dark-brown, sporangia stalked, swollen at the top; spores bilateral, translucent, tetrahedral.

A large genus comprising of about 80 species; 3 in Nagaland.

K E Y T O S P E C I E S

1a. Sori intramarginal; leaf margins narrowly reflexed . . . . . flexuosa

1b. Sori extra-marginal; leaf margins not reflexed.

2a. Fronds tufted, subsessile; midrib obscure on the lower surface . . . elongata

2b. Fronds not tufted, long-stipitate; midrib slightly raised on the lower surface . . . . . zesterifolia

Vittaria elongata Sw., Syn. Fil. 109: 302. 1806; Bedd., Handb. Ferns Brit. India Suppl. 404, t. 238. 1892; Holttum, Fl. Malaya 2: 614. 1968; Dixit in J. Econ. Tax. Bot. 2: 210. 1981.

(Plate 64)

Rhizome short creeping, slender; scales up to 0.5 cm long, lanceolate, blackish, hair-pointed at apex. Fronds 15 - 50 x 0.5 - 1 cm, tufted, simple, entire, coriaceous, glabrous, linear, tapering gradually towards both ends; midrib distinct throughout the upper surface, less distinct on the lower surface; veins simple, immersed, parallel, oblique to costa. Sori sunk in extrorse marginal groove, confluent, linear; paraphyses copious; sporangia short-stalked; spores translucent, pale, ovate to elliptical, verrucoid.

Extremely common (at certain places abundant) on moist mossy tree trunks; often on moss-covered rocks. A pendulous grass-like fern.

Fertile: February - December.

Distribution: MALAYA, QUEENSLAND, POLYNESIA, MAURITIUS, SRI LANKA, BURMA, INDIA - South India, North India and North-east India.

Specimens examined: Jamir 7986 Changki (Mokokchung dist., 1000 m); 6532 Wokha (Wokha dist., 1314 m); 7135, 7923 Kohima (Kohima dist., 1445 m).

Vittaria flexuosa Fee, Mem. Fan. Faug. 3, 16, 1851-52; Ching in Sinensia 1(12): 187. 1931; Holttum, Fl. Malaya 2: 611. 1968; DeVol in Fl. Taiwan 1: 237. 1980; Dixit in J. Econ. Tax. Bot. 2: 216. 1981;
V. lineata Bak. in Hook. Syn. Fil. 396. 1874; Bedd., Handb. Ferns Brit. India 407. 1883.

Rhizome short-creeping; scales up to 0.3 cm long, subulate, blackish, hair-pointed, slightly denticulated. Fronds tufted, 15 - 40 x 0.4 - 1 cm, linear-lanceolate, simple, entire, gradually tapering at both ends; midrib distinct on the lower surface, but not on the upper surface, margins usually inrolled; texture coriaceous, thin but firm; veins simple, immersed, parallel, very oblique. Sori along submarginal

grooves, almost or partially covered by inrolled margins; paraphyses branched, often simple, ending in obconical cells; sporangia short-stalked; spores pale, translucent, oval, verrucoid.

Rare; in mossy rock crevices or on the moss covered tree trunks in forests.

Fertile: February - December.

Distribution: CHINA, NEPAL, VIETNAM, TAIWAN, SRI LANKA, MALAYA, INDIA - Himalayas 700 - 3,600 m elevation.

Specimens examined: Jamir 6531 Wokha (Wokha dist., 1314 m).

Vittaria zosterifolia Willd., Sp. Pl. 5: 406. 1810; Ching in Sinensia 1: 179. 1931; Ito in J. Jap. Bot. 12: 467. 1936; et in Hara, Fl. East. Himal. 499. 1966; Copel., Fern Fl. Philip. 3: 550. 1960; DeVol, Fl. Taiwan 1: 238. (ed. 2). 1980; Dixit in J. Econ. Tax. Bot. 2: 212. 1981.

V. formosana Nakai in Bot. Mag. Tolyo 39: 176. 1925; V. lineata sensu Bedd., Handb. Ferns Brit. India 407. 1883 pro parte.

(Plate 65)

Rhizome slender, wide-creeping; scales up to 0.5 cm long, subulate, linear to lanceolate, subentire, black, clathrate. Stipes up to 8 cm long. Fronds 25 - 60 x 0.4 - 0.6 cm,

ribbon-like, distant, flexuous; apex obtuse or acute, gradually tapering towards base, midrib indistinct or slightly visible in the lower surface; texture thin but firm. Sori immersed in 2-lipped, marginal slit, continuous; paraphyses branched; sporangia short-stalked; spores translucent, monolete, verrucoid.

Not common; on tree trunks, noted in association with Asplenium nidus Linn. This fern gives a grass-like appearance.

Fertile: February - October.

Distribution: CHINA, TAIWAN, PHILIPPINES, INDONESIA, POLYNESIA, BURMA, THAILAND, LAOS, MALAYSIA, JAPAN, AFRICA, INDIA - Nagaland.

Specimens examined: Jamir 7986 Changki (Mokokchung dist., 1000 m); 6691 Tejit (Mon dist., 898 m).

Antrophyum

Kaulf., Enum. 197. 1824; C. Chr., Ind. Fil. 59. 1906; Copel., Gen. Fil. 223. 1947.

Rhizome short, creeping, fleshy, vascular system dictyostelic or solenostelic; scales clathrate, long, slender, often with hair-pointed apices; roots numerous, densely covered by brown root hairs. Stipes usually short, fleshy with two vascular strands; fronds tufted, simple or entire, pendulous, oblanceolate or elliptic, sessile or stipitate;

midrib or costa not prominent, except on basal part of the lamina; veins dichotomously forked forming areoles throughout the lamina, without free included veinlets. Sori elongated, linear, along the veins, usually sunk in grooves; paraphyses numerous; sporangia round, slender stalked; spores globose, brown, hyaline, tetrahedral.

Fairly large genus with about 40 species; only 1 species in Nagaland.

Antrophyum plantagineum (Cav.) Kaulf., Enum. Fil. 197. 1824; Bedd., Handb. Ferns Brit. India 403. t. 236. 1883.

Hemionitis plantaginea Cav., Descr. 260. 1802.

Anthrophyum reticulatum (Forst.) Kaulf., Enum. Fil. 198. 1824; Bedd., Ferns Brit. India 401. t. 235. 1883.

(Plate 66)

Rhizome short-creeping, fleshy; scales 0.2 - 0.7 cm long, dark-brown, lanceolate, broad at base, hair-tipped at apex, denticulate clathrate. Stipes absent or very short, up to 3 cm long, glabrous. Fronds 10 - 30 x 1 - 4 cm, lanceolate, narrowly decurrent at base, entire, coriaceous, glabrous, widest near or above middle, apex abruptly shortened, acute, often forked; midrib absent or only towards the base of lamina; veins reticulate; areoles long, narrow and distinctly raised on the upper surface. Sori linear, along the reticulate veins, immersed, often confluent; sporangia round,

slender-stalked; paraphyses linear, pale-brown; spores oval, light brown, hyaline.

Common; on tree trunks, usually in evergreen forests.

Fertile: July - November.

Distribution: POLYNESIA, QUEENSLAND, SRI LANKA, MALAYA, PHILIPPINES, INDIA - South India: Western ghats, Himalayas and Meghalaya up to 1520 m.

Specimens examined: Jamir 6075 Peren (Kohima dist., 1446 m); 6594 Peren (Kohima dist., 1446 m); 6696 Tejit (Mon dist., 898 m).

21. PARKERIACEAE

Aquatic annuals. Rhizome very short, erect, roots fibrous. Stipe scales thin, pale brown. Fronds glabrous, dimorphic, 3-lobed, pinnate or tripinnatifid, fertile fronds larger, much dissected; pinnae contracted; veins anastomosing, areoles without included veinlets. Sporangia borne in a single row along the marginal veins, globose, shortly stalked; annulus well developed, dehiscence transverse; spores large, tetrahedral, ribbed; false indusia much reflexed, nearly meeting at midrib.

A family with a solitary genus, Ceratopteris Brongn.

Ceratopteris

Brongn., Bull. Soc. Philom. 1821: 186. 1821; C. Chr., Ind. Fil. 169. 1906; Copel.,Gen. Fil. 83. 1947.

Characters of the family.

A genus of 4 species; 1 in Nagaland.

Ceratopteris thalictroides (Linn.) Brongn., Bull. Soc. Philom. 1821: 186. 1821; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 471. 1880; Bedd., Ferns Brit. India Pl. 75. 1863; Holttun, Fl. Malaya 2: 578. 1968; DeVol in Fl. Taiwan 1: 129. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 148. 1982.

Acrostichum thalictroides Linn., Sp. Pl. 2: 1070. 1753.

(Plate 67)

Rhizome short, fleshy, erect; roots fibrous. Stipes slender, about 20 cm long, whitish-green, stipe scales thin, pale-brown. Fronds dimorphic, sterile fronds mostly oblong, fertile fronds much taller than sterile and much dissected, bipinnatifid or tripinnatifid, usually 10 - 35 x 12 - 18 cm; pinnae alternate, rarely opposite, ultimate segments usually 0.2 - 0.3 cm across; sporangia borne in a single line along marginal veins, globose, short-stalked, dehiscence transverse; spores large, ribbed, tetrahedral; annulus well developed, false indusia much reflexed.

Rare, in lowlands of paddy fields, and in stagnant, shallow waters in open places.

Fertile: July - October.

Distribution: MALAYA, MADAGASCAR, SOUTHERN U.S.A., PACCIFIC ISLANDS, TROPICS OF SOUTH-EAST ASIA, CENTRAL AND SOUTH AMERICA AND THE WEST INDIES, INDIA - Southern India; Meghalaya, Assam.

Specimens examined: Jamir 6552 Chamuketema,Dimapur (Kohima dist., 250 m).

22 MARSILEACEAE

Small, marshy ferns, consisting of an elongate, stolon-like stem, growing on surface or slightly embedded in the mud, Rhizome long-creeping; siphonostelic; the cortex with numerous air cells or chambers. Leaves filiform or with 2 - 4 leaflets. Sori in tough sporocarps form near base of stipe or in axil of stipe and rhizome, containing a gelatinous ribbon to which are attached two rows of sori; one row of megasporangia in the centre, of each sorus and with a row of microsporangia on either side.

A family of three genera; one in Nagaland.

Marsilea

Linn., Sp. Pl. 2: 1090. 1753; Gen. Pl. ed. 5: 485. 1754; Copel., Gen. Fil. 230. 1947.

Characters of the family.

About 60 species; 1 in Nagaland.

Marsilea quadrifolia Linn., Sp. Pl. 1099. 1753.

(Plate 68)

Aquatic or amphibious ferns; rhizome 0.2 cm across, long-creeping with nodes and internodes, submerged in water or partly out of water, with their roots in the soil; rooting usually from the nodes, branched or unbranched. Stipes variable in length, 8 - 26 cm long, usually with 4 leaflets; largest leaflet up to 2.5 x 2 cm, usually entire or slightly crenate, hairless; veins distichously branched or forked, united to form a loose net work at marginal areas; sporocarps oval to bean-shaped, nearly horizontal or slightly upwardly directed, 2 - 4 in a group, which are borne on short, lateral branches of the petioles; pedicels adnate to the petiole or connate; heterosporous with both megasporangia and microsporangia.

Rather rare; in lowlands along paddy fields as well as in shallow, stagnant waters.

Fertile: August.

Distribution: EUROPE, NORTH AMERICA, RUSSIA, JAPAN, INDIA - S. India, N.E. India at lowlands.

Specimens examined: Jamir 6036 Rangapar/Dimapur (Kohima dist., 250 m).

23. HYMENOPHYLLACEAE

Small, delicate, filmy ferns, epiphytes or on moss-covered rocks. Rhizome usually slender, wide-creeping, rarely short, erect, covered with rhizoides and ramenta, sometimes rootless, vascular cylinder protostelic. Fronds simple or variously much divided , veins free. Stipes not articulate to rhizome. Lamina thin, filmy, one cell in thickness except for the veins, devoid of stomata, hairy on veins. Sori marginal or extramarginal; sporangia borne on an elongate or capitate receptacle (on extended veinlets); the annulus complete, oblique, dehiscence vertical; indusia tubular or 2-lipped to orbiculate, terminal on segments; spores trilete, usually viviparous, perineless; exine thin mostly transparent, smooth, or slightly granulose to spinulose, sometimes pitted or verrucate.

Genera about 42; 5 in Nagaland.

K E Y T O G E N E R A

1a. Indusium 2-lipped, almost cleft to base.

2a. Receptacles included; margin of fronds entire . . . . . 1. Mecodium

2b. Receptacles exserted; margins of fronds toothed . . . . . 2. Merignium

1b. Indusium tubular; if 2-lipped not cleft to base.

3a. Fronds with submarginal, false veins of short striae; involucre trumpet-shaped, mouth bifid . . . . . 5. Crepidomanes

3b. Fronds without such false veins; involucre otherwise.

4a. Fronds digitately, dichotomously lobed; mouth of involucre much enlarged . . . . . 3. Gonocormus

4b. Fronds pinnatifid or pinnately compound; mouth of involucre not much enlarged . . . . 4. Vandenboschia

1. Mecodium

Presl. ex Copel., Philip. J. Sci. 67: 17. 1938, et Gen. Fil. 33. 1947.

Terrestrials. Rhizome filamentous, glabrescent, wiry, creeping; rhizoides with dense soft, brown ramenta. Fronds pinnately compound, delicate, filmy, margin entire; pinnae variously lobed. Stipes and veins more or less densely covered with brown hairs; rachis winged, flat, undulate or crisped; veins promimently forked, free; indusia cup-shaped, 2-lipped; receptacles cylindrical or capitate, included.

K E Y T O S P E C I E S

1a. Stipes winged.

2a. Wing of stipe undulate; indusial lip circular, broader than length . . . badium

2b. Wing of stipe with crisped margins; indusial lip ovate-elliptic, longer than width . . . . . javanicum

1b. Stipe not winged.

3a. Rachis and stipe glabrous . . . . . polyanthos

3b. Rachis and stipe hairy . . . . . exsertum

Mecodium badium (Hook. & Grev.) Copel. in Philip. J. Sci. 67: 23. 1938; DeVol, Fl. Taiwan 1: 124. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 44. 1982.

Hymenophyllum badium Hook. & Grev., Icon. Fil. Pl. 76. 1828; Holttum, Fl. Malaya 2: 83. 1968.

H. javanicum Spring, var. badium Clarke in Trans.

Linn. Soc. Ser. 2 (Bot.) 1: 438. 1880; Bedd., Ferns Brit. India 33. 1883.

Rhizome wiry, long-creeping, glabrous. Stipes 3 - 8 cm long, 1 - 3 cm apart, winged, narrowed to base; wings on stipes and rachis about 0.2 cm wide, flat, entire or crisped. Lamina 5 - 15 x 3 - 6 cm, ovate-lanceolate in outline, pinnately compound to decompound (usually bipinnatifid to tripinnatifid), glabrous, pinnae close but not overlapping, rather curved upwards, up to 3.5 x 2 cm, with microspopic, clavate hairs along the veins. Ultimate segments or pinnules up to 1.3 x 0.5 cm, usually close, each with 2 - 8 pairs of segments, notched at apex. Sori abundant; indusia rounded, cleft at base, lips circular or wider than long, usually entire or crenulate; receptacles short, broadly capitate, forked.

Very common on moist, moss-covered tree trunks as well as on rocks in dense forests, specially near streams.

Fertile: May - July.

Distribution: MALAYA, VIETNAM, PHILIPPINES, CHINA, JAPAN, TAIWAN, INDIA - Himalayas, Sikkim.

Specimens examined: Jamir 6165 Pfutsero (Phek dist., 2134 m); 7136 Kohima (Kohima dist., 1445 m).

Mecodium exsertum (Wall. ex Hook.) Copel. in Philip. J. Sci. 67: 23. 1938; Iwatsuki in Fl. East. Himal. (3 Rep.) 171. 1975; Dhir, Ferns N.W. Himalayas 50. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 44. 1982.

Hymenophyllum exsertum Wall. ex Hook., Sp. Fil. 1: 109, t. 38. 1844; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 436. 1880; Bedd., Handb. Ferns Brit. India Suppl. 30, t. 16. 1883.

(Plate 69)

Rhizome wiry, wide-creeping. Stipes 1 - 4 cm long, slender, hairy, not winged; main rachis more or less densely clothed with ferruginous hairs, usually winged above or often throughout, lamina 5 - 15 x 2 - 4 cm, oblanceolate, sometimes ovate to shortly triangular, pinnately compound to decompound; lateral pinnae numerous, spreading, alternate, close, often overlapping, hairy beneath, glabrous above with a terminal pinna similar to lateral ones; sometimes the lowest pairs slightly reduced; largest pinnae up to 2.5 x 0.7 cm, oblanceolate in outline, deeply cut down more than half way down to costa into simple or forked, linear pinnules; pinnules of each pinna 2 - 5 pairs, usually close, shallowly bilobed. Sori abundant on the upper pinnae, usually on very short lobes, indusia cleft near to the base, lips ovate or oblong, sometimes acute at apex, margin usually uneven, rarely toothed towards apex.

Very common on moist and shady moss-covered tree trunks or rocks in dense evergreen forests.

Fertile: May - October.

Distribution: SRILANKA, MALAYA, at 1200 - 1800 m elevations, BURMA, INDIA - South India; Himalayas; Meghalaya at 600 - 1500 m elevation.

Specimens examined: Jamir 7134 Kohima (Kohima dist., 1445 m); 7179 Helipong forests (Tuensang dist., 1372 m); 6374 Morong forests, Sangpore (Tuensang dist., 2136 m).

Mecodium javanicum (Spring) Copel. in Philip. J. Sci. 67: 20. 1938; DeVol Fl. Taiwan 1: 126. (ed. 2). 1980; Dhir Ferns N.W. Himalayas 50. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 44. 1982.
Hymenophyllum javanicum Spring, Syst. Veg. 4: 132. 1827; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 437. 1880; Bedd., Handb. Ferns Brit. India Suppl. 32. 1892 (in part); Holttum, Fl. Malaya 2: 83. 1968.
H. crispatum Wall. ex Hook. et Grev., Icon. Fil. t. 77. 1827; Bedd., Ferns South India t. 207. 1865.

(Plate 70)

Rhizome wiry, rather wide-creeping, glabrous. Stipes 3 - 6 cm long, erect, slender, 1 - 2 cm apart, narrowly

winged almost to the base; wings on stipes and rachises up to 0.2 cm wide, flat, entire or crisped, glabrous. Lamina 6 - 12 x 3 - 5 cm, ovate-lanceolate in outline, pinnately compound (bipinnatifid to tripinnatifid); glabrous, pinnae close but not overlapping, oblique, the largest up to 4 x 1.5 cm, with about 5 pairs of pinnules; ultimate segments or pinnules up to 1 x 0.5 cm, pinnate, usually close to each other; pinnules again lobed; lobes up to 0.1 cm wide, entire, round or obtuse at tips. Sori abundant, dorsal on the upper pinnae; indusia 2-lipped almost to very base, the lip orbicular to oblong or ovate-elliptic, with irregularly toothed apices.

Common on moist,dense tree trunks as well as on rocks near streams in forests.

Fertile: May -June.

Distribution: NEW ZEALAND, MAURITIUS, PHILIPPINES, BOURBON, SRI LANKA, MALAYA, INDONESIA, AUSTRALIA, TAIWAN, NEPAL, BHUTAN, INDIA - Himalayas 1500 - 2400 m elevation and Meghalaya.

Specimens examined: Jamir 7215 Helipong forest (Tuensang dist., 1372 m).

Mecodium polyanthos (Sw.) Copel. in Philip. J. Sci. 67: 19. 1938; Iwatsuki in Fl. East. Himal. (3 Rep.) 171. 1975; DeVol Fl. Taiwan 1: 127. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 44. 1982. Hymenophyllum polyanthos Sw. in Schrard. J. 1800: 2. 102. 1801; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 437. 1880.

Rhizome wiry, wide-creeping. Stipes 1 - 4 cm long, slender, wingless or narrowly winged above; rachis narrowly winged, rather entire, flat, more or less hairy throughout the surface. Lamina variable in shape and size, up to 7 x 4 cm or more, obovate, tripinattifid, pinnae usually close but not overlapping, cut down into several pinnules; the pinnules with several segments or lobes; ultimate segments about 0.1 cm across, linear, entire, round to obtuse at tip. Sori terminal or axillary on the segments of the lobes; indusial lip ovate or rounded, entire.

Not common; on moist, shady tree trunks as well as on moss-covered rocks.

Fertile: May - June.

Distribution;S. E. ASIA, PACIFIC ISLANDS, SRI LANKA, BURMA, MALAYA, INDIA - Western ghats, Himalayas and Meghalaya at 1200 m elevation.

Specimens examined: Jamir 7138 Kohima (Kohima dist., 1445 m).

2. Meringium

Presl, Hymen. 24,t.8B. 1843; C.Chr.,Ind. Fil. 422. 1906.

Small epiphytic ferns. Rhizome creeping, glabrescent, rooting at intervals. Fronds pinnately compound, margin toothed or rarely entire, surface coarsely pitted, rachis usually slightly winged. Indusia 2-lipped, funnel-shaped or tubular towards base; receptacles cylindrical, slender, usually long exserted.

Meringium penangianum (Mett. et Chr.) Copel. in Philip. J. Sci. 67: 41. 1938; Baishya & Rao, Ferns & Fern-allies Meghalaya 45. 1982.

Hymenophyllum penangianum Mett. et Chr. in J. Linn. Soc. 39: 214. 1909; Holttum Fl. Malaya 2: 81. 1968.

Rhizome slender, long-creeping, more or less densely hairy, Stipes 1 - 3.5 cm long, slightly winged with fimbriate basal margins; main rachis winged. Lamina 4 - 8 x 2 - 4 cm, obovate; pinnae oblique to rachis, shortly stalked with well-spaced wings; largest pinnae up to 3 x 1.5 cm, sometimes the lowest pinna somewhat reduced, ultimate segments or pinnules up to 1 x 0.4 cm, usually deeply lobed; lobes up to 0.5 x 0.1 cm, linear, margin usually entire, often slightly sinuous, usually obtuse or acute at tips. Sori up to 4 pairs on each pinna, terminal on the lower acroscopic

lobes; indusial lips oval to bluntly triangular, receptacles long-protruding beyond the lips at maturity.

Common, on moist and shady tree trunks as well as on moss-covered rocks, forming dense mats. Also common on rocks where water drips down constantly.

Fertile: May - October.

Distribution: MALAYA, INDIA - Meghalaya at 1400 m elevation.

Specimens examined: Jamir 7176, 7168, 7177 Helipong forests (Tuensang dist., 1372 m); 6583 Wokha (Wokha dist., 1314 m).

3. Gonocormus

V.D. Bosch, Hymen. Jav. 1. 1861; C. Chr., Ind. Fil. 330. 18. 1906; Copel., Gen. Fil. 38. 1947.

Small epiphytic ferns. Rhizome filiform, rather long creeping, Fronds fan-shaped or pinnately dichotomously divided. Sori often sunk in lips of segments; indusia tubular, mouth dilated; receptacles exserted.

The production of proliferous fronds is a distinguishing character of this genus.

Gonocormus minutus (Blume) V.D.Bosch, Hymen. Jav. 7. Pl. 3. 1861; DeVol Fl. Taiwan 1: 111 (ed. 2). 1980. Trichomanes minutum Blume, Enum. Pl. Jav. 223. 1828. T. parvulum quoad Copel., Philip. J. Sci. 51: 145. Pl. 5. 1933; Holttum Fl. Malaya 2: 96. 1968; Bedd., Handb. Ferns Brit. India 39. 1883.

(Plate 71)

Rhizome very slender, wide-creeping, interlaced; sparsely covered with small, brown hairs; rootless. Stipes 0.5 - 1.5 cm long, wiry, not winged, rather densely hairy at base, sparsely or glabrous above. Lamina up to 1 cm long on each side, often wider than long, nearly orbicular in outline, cuneate or truncate at base, dichotomously branched or dissected more or less half way down towards the base, texture herbaceous, glabrous on both surfaces; veins close, prominent, dichotomously branched, without false veins between true veins. Sori sunk in the apices of the ultimate segments, or terminal on lobes, and free; indusia tubular or cup-shaped, rather broadly winged, distinctly dilated at the sides; receptacles exserted or protruding at maturity.

Rare, on moist moss-covered, shady tree trunks as well as on mossy rocks in forests.

Fertile: December.

Distribution: MALAYA, SIBERIA, CHINA, TAIWAN, JAPAN, PHILIPPINES, INDONESIA, AFRICA, JAVA, SRI LANKA, INDIA - South India, Nilgiris at 600 m elevation.

Specimens examined: Jamir 6493 Tejit (Mon dist., 100 m).

4. Vandenboschia

Copel., Philip. J. Sci. 67: 51. 1938; et Gen. Fil. 37. 1947.

Usually lithophytes, sometimes epiphytic. Rhizome slender, wiry, wide-creeping, unbranched, more or less densely clothed with brown hairs or tomentose. Stipes usually winged up to base, rarely not winged. Fronds simple or decompound; sometimes false veins present; indusia tubular or cup-shaped, often winged, receptacles exserted; protruding outwards from indusia at maturity.

A genus of about 25 species; 1 in Nagaland.

Vandenboschia radicans (Sw.) Copel., Philip. J. Sci. 67: 51, 54. 1938.

Trichomanes radicans Sw., Schrard. J. 1800, 2: 97. 1801; Bedd., Ferns Brit. India 43. 1883; Holttum, Fl. Malaya 2: 107. 1968.

(Plate 72).

Rhizome up to 0.4 cm across, wiry, wide-creeping, fronds usually 1 - 2 cm apart, more or less densely clothed with blackish-brown hairs. Stipes 5 - 15 cm long, rather stout, dark, winged near to the base, glabrous or sparsely hairy; lamina up to 30 x 10 cm, tri- to quadripinnatifid; pinnae numerous, sessile or subsessile, alternate, oblique to the main rachis; largest pinna up to 10 x 3 cm, ovate-lanceolate, subsessile or slightly winged, cuneate or unequal at base; deeply cut down almost quite to the costa into segments or pinnules; pinnules up to 2 x 1 cm, obovate, sessile, more or less deeply dissected into lobes, lobes about 0.3 cm wide, oblong, margin deeply serrate or toothed, texture firm, membranous, dark coloured when dry, glabrous on both surfaces of lamina; main rachis naked, usually winged. Sori lateral, 1 - 4 in a pinnule; indusia small, tubular, exserted, lipped or truncate at mouth; receptacles slender, elongate.

Not common; grows forming dense patches on moist, shady moss-covered rocks near rivers and streams and also on tree trunks in dense forests.

Fertile: December.

Distribution: MALAYA, SUMATRA, SIAM, FORMOSA, NEPAL, BHUTAN, INDIA - Himalayas, Meghalaya at 600 - 1500 m elevations.

Specimens examined: Jamir 7913 Kohima (Kohima dist., 1445 m).

5. Crepidomanes

Presl, Epim. Bot. 258. 1851; Copel.,Gen. Fil. 39. 1947.

Small terrestrial or epiphytic ferns. Rhizome filiform, elongate, covered with multicellular hairs. Fronds distant, pinnatifid with false veins. Sori axillary or terminal on segments, bivalved to urceolate; receptacle slender, usually exserted, protruding outwards from the involucre.

A genus of 10 - 15 species; 2 in Nagaland.

K E Y T O S P E C I E S

Stipe 2 - 4 cm long, glabrous; indusia with a triangular, rounded to ovate-obtuse apex . . . . . bipunctatum

Stipes 1 - 2 cm long, covered with blackish-brown hairs; indusia ovate-acute . . . . . late-alatum

Crepidomanes bipunctatum (Poir. ex Lamk.) Copel. in Philip. J. Sci. 67: 59. 1938; Baishya & Rao, Ferns & Fern-allies Meghalaya 43. 1982.
Trichomanes bipunctatum Poir. ex Lamk. in Encyclop. Meth. Bot. 8: 69. 1808; Bedd., Ferns Brit. India 41. 1881; Holttum, Fl. Malaya 2: 99. 1968.

Rhizome wide-creeping, rather slender, more or less densely covered with blackish-hairs. Stipes 2 - 4 cm long, usually glabrous, slightly winged in the upper part, lamina 3 - 6 x 2 - 4 cm, deltoid, to ovate in outline, deeply tripinnatifid; pinnae alternate, shortly petiolate, with slight wings; largest pinna up to 2 x 1.5 cm, ovate, rhomboidal, deeply pinnatifid to a narrowly winged costa; the pinnules up to 1 x 0.5 cm, again deeply pinnatifid into lobes or segments, segments up to 0.5 x 0.1 cm, linear, entire, with submarginal, false veins, often a few short, false veins scattered between costa and margins; rachis very narrowly winged, often not winged. Sori axillary or terminal on the segments; indusia slightly winged, elongate-ovate, the mouth distinctly 2-lipped, enlarged with a triangular, rounded to ovate-obtuse apex; receptacles slender, exserted, protruding outwards from the involucre.

Common, on moist shady tree trunks in dense forests.

Fertile: October.

Distribution: SRI LANKA, BURMA, MALAYA, INDIA - South India; western ghats; N.W. India.

Specimens examined: Jamir 6514 Wokha (Wokha dist.,1314 m).

Crepidomanes late-alatum (V.D.Bosch) Copel. in Philip. J. Sci. 51: 192, Pl. 25, 26. 1933; Iwatsuki in Fl. East. Himal. (3 Rep.) , 171. 1975; DeVol Fl. Taiwan 1: 103 (ed. 2). 1980.

Didymoglossum late-alatum V.D. Bosch Ned. Kruidk. Arch 5: 138. 1863.

Trichomanes late-alatum (V.D.Bosch) C. Chr., Vesh. Nat. Ger. Basel 11: 424. 1896.

Rhizome wide-creeping, covered with black, multicellular hairs; roots few, covered with brown ramenta. Stipes 1 - 2 cm long, distant, winged in the upper part, covered with blackish-brown hairs; rachises winged throughout; lamina up to 10 x 2.5 cm, narrowly deltoid to ovate-lanceolate, bipinnate to tripinnatifid; pinnae about 1.5 x 0.8 cm, deeply cut down into segments or pinnules; segments usually linear, lanceolate, acute, margin entire; bearing sub-marginal, false veins (stiae); indusia 2-lipped, usually elongate, ovate, acute;receptacle exserted at maturity.

Rare on shady moss-covered rocks as well as on moist tree trunks near streams in forests.

Fertile: December - Febaruary.

Distribution: MALAYA, SUMATRA, CHINA, TAIWAN, JAPAN, INDIA - N.E. India.

Specimens examined: Jamir 7074 Changki (Mokokchung dist., 1000 m); 7931 Kohima (Kohima dist., 1445 m).

24. DICKSONIACEAE

Arborescent plants; stipes tall, stout, erect, densely covered by a mass of hairs, not articulate to rhizome. Fronds large, tripinnatifid; veins free. Sori marginal or submarginal, terminal on veins, protected by a bivalvate or cup-shaped indusium. Sporangia gradate; annulus conspicuous, complete, oblique; paraphyses many; spores trilete or tetrahedral.

3 genera; 1 in Nagaland.

Cibotium

Kaulfuss, Berlin Jaharb. Pharm. 21: 53. 1820; C. Chr., Ind. Fil. 183. 1906; Copel., Gen. Fil. 49. 1947.

Rhizome stout, prostrate or erect, base of stipe clothed with brown, shining hairs. Fronds large, tripinnatifid. Sori covered by two lobed indusia, open laterally; sporangia gradate; spores annulo-trilete or annulate.

A genus of about 12 species, mostly confined to South East Asia, Hawaii, Central America and Taiwan; 1 species in Nagaland.

Cibotium baromtez (Linn.) J. Smith, in Hook. J. Bot. 1: 437. 1842; Bedd., Handb. Ferns Brit. India Suppl. 24, f. 13. 1892; DeVol, Fl. Taiwan 1: 131. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 48. 1982.

Polypodium baromtez Linn., Sp. P. 1092. 1753.

Cibotium glaucescens Kunze in Hook., Sp. Fil. 1: 82. 1844.

C. assamicum Hook., Sp. Fil. 1: 83, t. 293. 1844.

Dicksonia baromtez Hook. et Baker, Syn. Fil. 49. 1867; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 435. 1880.

(Plate 73)

Arborescent. Rhizome stout, prostrate or ascending. Fronds 1 - 2.5 m long, tripinnatifid, glabrous but covered by whitish powdery substances on both surfaces. Stipes 25 - 50 x 0.5 - 1.5 cm, greenish or brownish, base covered with dense, linear, brown, shining, 1.5 cm long, hair-like scales; upper portion of stipe and rachis covered with small, flaccid hairs; lamina up to 1.5 m long; pinnae stalked, 30 - 80 cm long, lower pinnae shortened, deflexed; pinnules short stalked; segments spiculate, margin serrulate; veins free, fertile veins simple, sterile often forked. Sori globose, covered by 2 indusial lobes, terminal on the veins, outer lobe larger; sporangia gradate, annulus complete;

spores ridged, annulate or annulo-trilete; exine with proximal face bearing 3 rows of short, laesural ridges, distal face with a distal ridge.

Fairly common in forest cleared areas and road-sides.

Fertile: July - November.

Distribution: INDONESIA, PHILIPPINES, TAIWAN, INDIA - N.E. India.

Specimens examimed: Jamir 6605 Mon (Mon dist., 898 m); 6168 Changki (Mokokchung dist., 1000 m).

25. CYATHEACEAE

Mostly tree ferns with massive, tall, erect trunk. Stems usually unbranched, covered with interlacing roots; the trunk and bases of stipes more or less densely covered with scales, sometimes hairy, rarely spiny. Fronds usually large, bipinnate to tripinnatifid, mostly coriaceous, spirally arranged at the apex of the stem. Veins free or forked. Sori superficial, dorsal; indusia globose, at first covering the sorus, spliting into lobes, or vestigial or absent; sporangia small, shortly stalked, attached to short or elongated receptacle, sometimes with paraphyses; maturation gradate; annulus complete, oblique, with definite stomium, dehiscence by lateral slits; spores tetrahedral without perispore.

About 6 - 8 genera depending on the conception of authors; 1 in Nagaland.

Cyathea

Smith, Mem. Acad. Turin, 5: 416. 1793; Copel., Gen. Fil. 95. 1947.

Characters of the family.

A genus of about 230 species of which 18 from Asia; 7 in Nagaland.

K E Y T O S P E C I E S

1a. Sori indusiate.

2a. Stipe distinctly spinulose; pinnules dentate . . . . . spinulosa

2b. Stipe smooth or very minutely blunt tuberculate at base.

3a. Pinnules not biforked at the tip; pinnule lobes 3 - 4 mm apart, 20 x 3 cm, ashy beneath; sori from base to almost to the tip of segments . . . . . brunoniana

3b. Pinnules biforked at the tip; pinnule lobe 1 - 2 mm apart, close, 10 - 12 x 2 - 3 mm, not ashy; sori not reaching the tip of the segments .. holttumiana

1b. Sori exindusiate.

4a. Sori not forming an inverted 'V'-shape; basal basioscopic vein always from costule . . . . . khasiana

4b. Sori oblique to the costule, forming an inverted 'V' shape.

5a. Lamina densely hairy; scales ovate-lanceolate, black-shining, appressed to the stipe. . . . . andersonii

5b. Lamina glabrous or sparsely hairy; scales various.

6a. Basal basioscopic vein arising from costae and costules, stipe scale thin, shining, golden-brown . . henryii

6b. Basal basioscopic vein arising from costae; stipe scales blackish.

7a. Stipe scales linear, margin hooked . . . . . gigantea

7b. Stipe scales broadened at base, linear and entire . . . . . recommutata

Cyathea andersonii (Scott. ex Bedd.) Copel., Philip. J. Sci. 4C: 33. 1909.

Alsophila andersonii Scott. ex Bedd., Ferns Brit. India 12. 1883; Tryon, Contr. Gray. Herb. (No.CC) 31. 1970.

Trunk massive, erect to semierect, 4 - 5 m tall. Stipes muricate, rough, black to dark-brown, more or less densely covered with dark, broad, cordate to deltoid scales which are suddenly narrowed, lanceolate, subulate, hair-tipped, deciduous, up to 2 x 0.4 cm long; rachis dark brown, tawny villous below, somewhat scabrous above. Fronds up to 2.5 m long, ovate-lanceolate in outline, bipinnate, pilose; pinnae up to 60 x 27 cm, oblong-acuminate, pinnate; tertiary pinnae or pinnules numbrous, 20 - 25 pairs, alternate or subopposite, shortly stalked; largest pinnule up to 15 x 2.5 cm, linear oblong, cordate to deltoid at base, lanceolate acuminate, margin cut down 2/3 or nearly almost to the costa into lobes; lobes up to 0.5 cm wide at base, oblong, slightly falcate, obtuse or round, finely serrate or crenate; texture rather thin, membranous; costae, costule, veins and veinlets clothed with long, weak, whitish hairs beneath, rather sparsely above; veins 6 - 12 pairs in each lobe, simple or once forked. Sori globose, closer to margin than costule, mixed with long paraphyses; exindusiate.

Gregarious in moist dense forests near streams. Some recent authors treat this under Alsophila andersonii Scott. ex Bedd. (Tryon, 1970).

Fertile: October.

Distribution: INDIA - Sikkim at 300 - 1000 m elevation Meghalaya.

Specimens examined: Jamir 6651 Mon (Mon dist., 898 m).

Cyathea brunoniana (Hook.) Clarke et Baker in J. Linn. Soc. 24: 409. 1888; Baishya & Rao, Ferns & Fern-allies Meghalaya 50. 1982.

Alsophila brunoniana Wall. ICat. 7073. 1829 (nom. nud.) ex Hook. Sp. Fil. 1: 52. 1844. (Plate 74).

Trunk massive, erect, up to 4.5 m tall. Stipes and rachises yellowish-brown to dark-brown, sparsely covered with tubercles, glabrous. Fronds up to 3 m tall, bipinnate; pinnae up to 75 x 30 cm, stalked (about 2 cm long), delto-oblanceolate in outline, pinnate; secondary rachis slightly muricated or glabrous; tertiary pinnae or pinnules numerous, alternate, sessile; largest pinnule up to 16 x 3.5 cm, oblong-acuminate, deeply cut down quite near to the costa into lobes; lobes up to 2 x 0.4 cm, linear-subulate, slightly falcate, obtuse, serrate, or crenate; texture thin, subcoriaceous; costae and costules minutely hairy on both surfaces; veins 8 - 16 pairs, forked once or rarely twice, basal veins always from costule. Sori rather large, globose, arranged in two rows, one on either side of costule, very close to the costule; spores light-brown, hyaline.

Abundant, on slopes of hills in moist, dense forests; sometimes gregarious in forest cleared areas and near streamlets. One of the commonest of Cyathea spp. in Nagaland.

Fertile: July - October.

Distribution: BHUTAN, INDIA - Sikkim, Meghalaya.

Specimens examined: Jamir 6167 Changki (Mokokchung dist., 1000 m); 6649 Mon (Mon dist., 898 m); Tryon (1970) treats this species under a distinct genus Sphaeropteris as S. brunoniana (Hook.) Tryon.

Cyathea gigantea (Wall. ex Hook.) Holttum in Gard. Bull. Str. Sett. 8: 318. 1935; Baisya & Rao, Ferns & Fern-allies Meghalaya 50. 1982.

Alsophila gigantea Wall. ex Hook., Sp. Fil. 1: 53. 1844.

A. glabra sensu Bedd., Handb. Ferns Brit. India 14. 1883.

Trunk massive, erect, up to 5 m tall. Stipes dark to black-purplish, rough scaly at base, scales caducous above; scales up to 1.5 x 0.2 cm, long linear-lanceolate, dark-brown, margin toothed; rachis slightly dark to purplish-brown, rather shining, glabrous or subglabrous, a few appressed hairy above. Fronds up to 3 m tall, bipinnate; secondary pinnae up to 80 x 30 cm, shortly stalked, broad deltoid to oblanceolate in outline, pinnate; secondary rachises setose beneath, glabrous above; tertiary pinnae or pinnules numerous, 20 - 30 pairs, alternate, sessile, usually slightly reduced at lowest basal pinnae; largest

pinnule up to 15 x 0.5 cm, base slightly unequal or cuneate, broadest somewhat near base, gradually narrowed into an acuminate apex, margin cut down 2/3 way to costa into lobes; lobes up to 0.6 cm wide at base, oblong, slightly oblique, round, crenate or toothed, the lowest basal lobe sometimes shortened and almost free; costae setose on ventral surface, upper surface sparsely clathrate scaly; texture rather thin, subcoriaceous; veins 5 - 7 pairs in each lobe, simple, basal basioscopic vein always directly from the costae, not from costules. Sori rather large, globose on veins away from costules, forming an inverted 'V'- shape; exindusiate.

Rather abundant, near streams and river banks; and also on mountains slopes. This is one of the commonest of Cyathea spp. in Nagaland.

Fertile: February.

Distribution: MALAYA, INDIA - Eastern Himalayas, Meghalaya.

Specimens examined: Jamir 7981, 7994, 7983 Changki (Mokokchung dist., 1000 m); Tryon (1970) keeps this species under Alsophila.

Cyathea henryi (Bak.) Copel. in Philip. J. Sci. Bot. 4: 38. 1909; Baishya & Rao, Ferns & Fern-allies Meghalaya 50. 1982.

Alsophila henryi Bak. in Kew Bull. 1898: 229. 1898.

Trunk massive, erect, up to 5 m tall. Stipes blackish to dark-brown, scaly at base; scales up to 2 x 0.2 cm, linear-lanceolate, pale to dark-brown, shining, hair-tipped; rachis dark-brown, glabrous. Fronds large, up to 2.5 m long, bipinnate; secondary pinnae up to 60 x 25 cm, oblong-acuminate in outline; tertiary pinna or pinnules numerous, 20 - 26 pairs, alternate, shortly stalked; largest pinnule up to 15 x 2.5 cm, linear oblanceolate, truncate or slightly unequal at base, acuminate, margin cut down 1/2 - 2/3 way towards costa into lobes; lobes up to 0.5 cm wide at base, slightly oblique, obtuse or round, slightly crenate or serrate; basal pair of pinnae somewhat reduced; costae setose beneath, scaly above, scales clathrate, terminating into dark setae; veins 7 - 10 pairs, simple, basioscopic basal pair arising from costae and costules. Sori globose, closer to costule towards distal ones, lower ones more distant from it, forming an inverted 'V' shape, exindusiate.

Rare, rather in exposed areas near streams and river sides; sometimes on hill slopes in dense evergreen forests.

Fertile: February - October.

Distribution: Meghalaya.

Specimens examined: Jamir 7979 Changki, Tzumet (Mokokchung dist., 1000 m); 6403 Khensa (Mokokchung dist., 1300 m). Tryon (1970) places this taxon also under Alsophila.

Cyathea khasyana (Moore ex Kuln.) Domin in Acta Bot. Bohem. 362. 1930; Baishya & Rao, Ferns & Fern-allies Meghalaya 51. 1982.

Alsophila khasyana Moore ex Kuln. in Linnaeae 36: 154. 1869.

Trunk rather massive, erect, up to 4.5 m tall. Stipes and rachis black to dark-brown, scaly at base; scales up to 2 x 0.2 cm, broad ovate at base, suddenly narrowed, linear-lanceolate, hairy-tipped, dark-brown, rather shining. Fronds up to 2.5 m long, bipinnate; secondary pinnae up to 45 x 18 cm, oblong acuminate, pinnate; secondary rachis brown, glabrous or sparsely scaly; teriary pinnae or pinnules numerous, about 16 - 20 pairs, alternate, sessile; the lowest basal pair somewhat shorterned; largest pinnule up to 12 x 2 cm, linear-oblong, truncate at base, acuminate at apex, margin cut down 2/3 or almost nearly to the costa into lobes; lobes up to 0.4 cm wide at base, slightly oblique, round, slightly crenate; costae and costules not

hairy, setose beneath, rather densely scaly towards base; scales up to 0.5 cm long, brown, shining, not clathrate, with setose margin. Veins 5 - 9 pairs on each lobe, basal basioscopic veins always from costule, simple, sometimes forked once. Sori globose, close to the costule throughout, exindusiate; sporangia dark-brown; spores light brown, hyaline.

Frequent, in moist dense hilly forests.

Fertile: October.

Distribution: Meghalaya.

Specimens examined: Jamir 6347 Morong forests Sangpore (Tuensang dist., 2136 m). Tryon (1970) treats this under Alsophila.

Cyathea holttumiana, sp. nov.

(Plate 75).

Trunk massive, erect, up to 4 m tall. Stipes, rachises and costules pale-brown, glabrous. Fronds up to 2.5 m tall, bipinnate; largest secondary pinnae up to 60 x 25 cm, deltoid to oblong-lanceolate, stalked (up to 2 cm long), pinnate; tertiary pinnae or pinnules numerous, subopposite or alternate; largest pinnules up to 13 x 2.2 cm linear, oblong-lanceolate, sessile, usually biforked at apex, deeply cut down almost to the costa into lobes; lobes

up to 1.2 x 0.3 cm, slightly falcate, rounded at apex, margin entire; texture thin, subcoriaceous; glabrous on both surfaces; veins 6 - 15 pairs, forked once, start from costule up to the margin. Sori up to 0.1 cm wide, small, globose, arranged in two rows, one on either side of costule, more closer towards costule than margin; exindusiate; spores trilete, pale-brown, hyaline; exine granulose.

Rare, in moist hill slopes in forests. This species very closely resembles C. brunoniana but differs in the nature and size of leaves, the pinnules which are biforked at the tip and the entire margins of lobes; and the spores which are trilete. The specific epithet commemorates Dr. R.E. Holttum, leading Pteridologist of the century.

Fertile: February.

Distribution: Nagaland (India).

Specimens examined: HOLOTYPE: Jamir 7996 Changki Changki (Mokokchung dist., 1000 m) (NEHU) (It is proposed to deposit the Holotype in CAL after the valid publication of this Taxon).

(Valid publication is undertaken elsewhere).

Cyathea recommutata Copel. in Philip. J. Sci. 4C: 36. 1909; et in Gen. Fil. 98. 1947; et in Gard. Bull. 27 (2): 173. 1974; Holttum Fl. Malaya 2: 125. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 51. 1982.

Alsophila commutata Mett. Ann. Mus. Bot. Lugd. Bot. 1: 53. 1863.

Trunk rather slender, large, up to 5 m tall. Stipes black to dark-brown, slightly rough by the bases of fallen scales; more or less densely scaly at base; scales up to 1 x 0.2 cm, broad ovate at base, suddenly narrowed, linear-lanceolate, apex hair-tipped, dark-brown, glossy, edges pale, fragile. Fronds up to 2 m long, bipinnate; basal pinnae small, not closely placed, rigidly spreading on each side of stipe, bearing a few less deeply lobed leaflets; secondary pinnae up to 65 x 25 cm, oblong, acuminate; tertiary pinnae or pinnules numerous, 20 - 30 pairs, alternate, shortly stalked; pinnules nearly dimorphic, fertile pinnules more contracted than sterile ones; largest pinnule up to 13 x 1.5 cm, linear, oblong, acuminate, base truncate, lanceolate acuminate, margin deeply cut down 1/2 way towards the costae into lobes or segments; lobes up to 0.5 cm wide at base, obtuse, slightly crenate; costae and costules clothed with narrow, dark, lanceolate, glossy scales with pale edges; veins 5 - 8 pairs, usually simple, rarely forked

once. Sori exindusiate, closer to costule towards distal ones, lower side more distant, rather inverted 'V' shaped; spores hyaline, with 3 distinct grooves; paraphyses short, dark.

Frequent, near river banks and also near forest margins in shady places.

Fertile: May.

Distribution: BURMA, MALAYA, CENTRAL AND SOUTHERN SUMATRA, INDIA - Meghalaya.

Specimens examined: Jamir 7106 Changki,Tzulu (Mokokchung dist., 240 m).

Cyathea spinulosa Wall. ex Hook. Sp. Fil. 1: 25, t. 12C, 1844; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 429. 1880; Bedd., Handb. Ferns Brit. India 6. t. 3, 1892; Iwatsuki in Fl. East. Himal. (3 Rep.) 180. 1975; DeVol Fl. Taiwan 1: 136 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 51. 1982.

Alsophila spinulosa (Hook.) Tryon in Contr. Gray Herb. (No.CC) 32. 1970.

Trunks arborescent, massive, erect, up to 4.5 m or more tall. Stipes and rachis strongly aculeate, or spiny,

dark-brown; scaly at base, linear-lanceolate, hair-tipped, coriaceous. Fronds up to 2.5 m long, bipinnate, coriaceous; secondary pinnae up to 60 x 25 cm, oblong-acuminate in outline, pinnate, short-stalked; secondary rachis purplish to pale brown, sharp and short spiny throughout; tertiary pinnae or pinnules numerous, up to 25 or more pairs, alternate, shortly stalked or sessile; the lowest pair somewhat reduced; largest pinnule up to 15 x 3 cm, linear-oblong, truncate or subtruncate at base, gradually tapering into acuminate apex; margin deeply cut down almost quite near to the costa into lobes or segments; lobes up to 1.5 x 0.5 cm, slightly oblique, round or obtuse at apex, margin rather sharply crenate or serrate, upper surface hispid along the rachis, rachillae and costae; lower surface glabrous with small thin ovate or irregular scales along costae and veins; veins usually forked once, free. Sori round, rather large, copious near the costules in one row on either side of the costa; indusia thin, membranous, globose, fugaceous; spores irregular in shape; pale-brown, hyaline.

Frequent, in moist shady forests, sometimes near rivers as well as in edge of dense forests.

Fertile: October.

Distribution: NEPAL, BURMA, CHINA, TAIWAN, JAPAN, INDIA - Meghalaya Upper Shillong (at 1600 - 1900 m altitude).

Specimens examined: Jamir 6457, 6434 Morong forests (Tuensang dist., 2100 m); 6348 Zenheboto (Zenheboto dist., 1874 m). This is another Cyathea sp. placed under Alsophila by Tryon (1970).

26. DENNSTAEDTIACEAE

Terrestrials. Rhizome slender, creeping or ascending, clothed by hairs or often by narrow scales; vascular system usually solenostelic or rarely dictyostelic. Stipes stout, erect, grooved on the upper surface, hairy or scabrous, not articulate to rhizome, vascular system a solitary, thin gutter-shaped strand; lamina pinnate to pinnately decompound; veins free or anastomosing without included, free veinlets. Sori marginal on the vein tips, protected by a cup-shaped or 2-lipped indusium; sporangia with slender, elongated stalks, with 3-thick cells at the capsule base; paraphyses absent; spores small, tetrahedral or rarely bilateral, perineless; exine granulose, or verrucose.

A family of 9 genera; 3 in Nagaland.

K E Y T O G E N E R A

1a. Sori indusiate.

2a. Sori marginal . . . . . 1. Dennstaedtia

2b. Sori intramarginal . . . . . 2. Microlepia

1b. Sori exindusiate . . . . . 3. Monachosorum

1. Dennstaedtia

Bernh. Schrard. J. Bot. 1800, 2: 124. 1801; C. Chr., Ind. Fil. 216. 1906; Copel., Gen. Fil. 50. 1947.

Terrestrials. Rhizome stout, creeping, clothed with rather stiff, dark hairs; stipes well spaced; vascular system solenostelic. Stipes and rachis stout, erect, hairy or glabrous, grooved above; lamina usually large, pinnately decompound, more or less deltoid, shortly hairy or naked; veins free, forked. Sori marginal, terminal on the veins; the superior and inferior indusium connate forming a cup-shaped structure which is usually reflexed towards the lower surface of the lamina; sporangia slender stalked; annulus of 10 - 28 thick walled cells, interrupted; spores tetrahedral, trilete.

A genus of 70 species; 2 in Nagaland.

K E Y T O S P E C I E S

Sori confined to the terminal portion of segments of pinnules; pinnules 2 - 4 cm long . . . . . scabra

Sori in a single row on either side of the vein of the pinnule segments; pinnules 4 - 8 cm long . . . . . appendiculata

✓Dennstaedtia appendiculata (Wall.) J. Smith, Hist. Fil. 265. 1975; Bedd., Handb. Ferns Brit. India (with Suppl.) 26. 1892; Mehra & Bir, Pteridophytic Fl. Darjeeling & Sikkim 116. 1964; Iwatsuki in Fl. East. Himal. (3 Rep.) 174. 1975; Dicksonia appendiculata Wall. List. n. 69, 1828 nom. ; Clarke in Trans. Linn. Soc. London Ser 2 (Bot.) 1: 436. 1880.

Rhizome short, massive, stout, densely covered with long-linear, soft, golden brown, hair-tipped scales; scales up to 2 cm long. Stipes up to 80 cm or more long, tufted, stout, pale-brown, shining, densely scaly at base; rhizome more or less sparsely scaly above; lamina up to 80 x 35 cm, or more, ovate-lanceolate in outline; bipinnate; rachis more or less densely covered with brown scales; lowest pinnae up to 10 pairs, alternate; primary pinnae up to 30 x 16 cm or more, deltoid to ovate-lanceolate in outline, petiole up to 1.5 cm long; secondary pinnae up to 10 or more pairs, alternate with largest up to 9 x 3.5 cm or more, deltoid to ovate-lanceolate, shortly petiolate, acuminate, deeply cut down quite to the rachis into pinnules or segments; largest pinnules up to 2 x 1 cm, linear-oblong, sessile, broadest somewhat at base, round or obtuse at apex, margin shallowly lobed or crenate; texture thin, subcoriaceous, costae and costule more or less densely covered with scales

on the undersurface; veins forked once or twice, often more, free. Sori small, round, more closer to costule than margin, 1 - 7 or more on each pinnule, indusia cup-shaped, globose; sporangia slender stalked; spores small, trilete; exine granulose to verrucose.

Not common; in jhummed forests and in open areas.

Fertile: May.

Distribution: NEPAL, INDIA - Darjeeling, Sikkim.

Specimens examined: Jamir 7212, 7111 Changki village (Mokokchung dist., 1000 m).

Dennstaedtia scabra (Wall. ex Hook.) Moore Ind. Fil. 307. 1861; Bedd., Handb. Ferns Brit. India 24, t. 12, 1883; Iwatsuki in Fl. East Himal. (3 Rep.) 174. 1975; Wang-chueng Shieg in Fl. Taiwan 1: 241 (ed. 2). 1980; Dhir, Ferns N.W. Himalayas 52. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 88. 1982.

Dicksonia scabra Wall. ex Hook., Sp. Fil. 1: 80, t. 27B. 1844; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 436. 1880.

Dennstaedtia deltoidea Bedd., Ferns South India t. 258. 1863.

Rhizome about 0.8 cm thick or more, rather stout, wide-creeping, covered with pale-brown hairs, Stipes 10 - 45 x 0.2 - 0.5 cm, reddish-brown, castaneous, hairy at base; lamina 20 - 45 x 10 - 20 cm, deltoid to ovate, tri to quadripinnate, scabrous; rachis scabrous; pinnae 20 - 30 pairs, alternate; largest pinnae 15 - 20 x 4 - 6 cm, distant on rachis, lanceolate, basal pinnules very close to the main rachis, other pinnules gradually reduced to a single lobe, acute at apex; largest pinnules up to 7 x 3 cm, deltoid-lanceolate, slightly oblique or near right angles to the costa, deeply cut down almost to the costules into lobes; the lobes about 1 x 0.5 cm, oblong, obtuse, slightly decurrent at base, margin crenate, more or less deeply lobed towards base; mostly on the acroscopic side; texture herbaceous; veins free, forked. Sori 2 - 8 on each lower segment or teeth; indusia subglobose, cup-shaped, outer lip attached half the length by its side, half opens outwards; lower lip rudimentary, almost absent; annulus of 10 - 17 thick walled cells; spores pale-brown; exine smooth.

Abundant, along the roadsides, both in shady as well as open places in forests.

Fertile: July -December.

Distribution: CHINA, SRI LANKA, KOREA, JAPAN, TAIWAN, PHILIPPINES, BORNEO, BURMA, MALAYA, INDIA - South India,

Himalayas up to 1200 - 2500 m elevations; Khasi hills up to 1800 m.

Specimens examined: Jamir 6157 Pfubero (Phek dist., 2134 m); 6445, 6456, 7950, 7949 Zenheboto (Zenheboto dist., 1874 m).

2. Microlepia

Presl, Tent. Pterid. 124. 1836; C. Chr., Ind. Fil. 425. 1906; Copel., Gen. Fil. 51. 1947.

Terrestrials. Rhizome creeping, hypogeal, densely covered with ferruginous hairs; vascular system simple, solenostelic. Stipes erect, ratherstout, usually covered with short-hairs; vascular strand single, 'V' shape; rachis shallowly grooved; costae of pinnules slightly grooved; lamina pinnate to decompound, ovate-acute to deltoid in outline; pinnae usually oblique lanceolate to narrowly deltoid, hairy on both surfaces; ultimate leaflets always unequal at base, usually crenate or lobed; texture papyraceous or herbaceous; veins free, forked, not uniting. Sori submarginal, terminal on the veins; indusia thin, cup-shaped, attached by base and sides, apex truncate, often hairy; sporangia stalked; spores tetrahedral, trilete; exine smooth or little sculptured.

A genus of about 50 species distributed in tropics and subtropics of the old world; 11 species in Nagaland.

K E Y T O S P E C I E S

1a. Indusium rudimentary; spores spinulose . . . . . trapeziformis

1b. Indusium half-cup shaped, fixed by the base and side.

2a. Posterior side of the pinnae base auricled; stipe hairy . . . . . hookeriana

2b. Posterior side of the pinna base not auricled; stipe hairy or not.

3a. Fronds unipinnate; pinnae deeply cleft . . . . . marginata

3b. Fronds bipinnate; pinnae various.

4a. Fronds glabrous, the rachis grooves interrupted; sori confined to margins . . . . . platyphylla

4b. Fronds hirsute or strigose; rachis grooved or not, if grooved uninterrupted; sori marginal or on the lamina lobes.

5a. Rhizome wide-creeping.

6a. Sori 1 - 3 in each pinnule; pinnule entire or slightly dentate.

7a. Veins distinct; pinna lobes acute . . . . . marginata

7b. Veins not visible; pinna lobes rounded . . . . . hirta

6b. Sori 4 - 8 in each pinna; pinnules pinnatifid lobate on acroscopic edge, more or less entire on basioscopic edge . . . . . strigosa

5b. Rhizome stout, short-creeping.

8a. Costae, costules and veins hairy on the ventral surface and glabrous above.

9a. Indusium marginal; veins on lower surface distinctly raised; veins on upper surface not distinctly raised . . strigosa

9b. Indusium intramarginal, on the acroscopic edge of the lobes; veins on lower surface not distinctly raised . . . . . puberula

8b. Costae, costules and veins hairy or setose on both surfaces.

10a. Indusium setose.

11a. Pinnule lobes entire . . . . . trapeziformis

11b. Pinnule lobes toothed.

12a. Hairs very few, confined to veins . . . . . speluncae var. hancei

12b. Hairs moreor less throughout the surface . . . . . speluncae

10b. Indusium otherwise . . . . . .pilusula

Microlepia hirta (Kaulf.) Presl., Tent. Pterid. 125. 1836; Bedd., Handb. Ferns Brit. India 68. 1883; Dhir, Ferns N.W. Himalayas 54. 1980.

Rhizome about 1 cm across, creeping, young parts covered with short, pale-brown hairs; roots wiry, spreading. Stipes 30 - 60 cm long, rather stout, shining, glossy, glabrous or shortly hairy; lamina 40--60 x 20 - 30 cm, tripinnate, ovate-deltoid; rachis more or less densely hairy, pale-greenish; largest pinnae up to 40 x 15 cm, slightly oblique, to the rachis, petiolate; largest pinnule up to 10 x 3 cm, oblong or ovate to linear lanceolate, ultimate segment or largest leaflets 2 x 1 cm, more or less oblique to costules, distinctly spaced or touching each other, unequal at base; apex rounded, edges deeply lobed in larger ones; lobes entire or subentire, rhomboid, often slightly crenate; texture thin, soft; costae and costules shortly hairy on both surfaces; veins free, forked, pale, hairy, more or less prominent beneath. Sori intramarginal, near the sinuses of lobes; indusia half cup-shaped, hispid, often glabrous; sporangia copious; spores brownish; exine slightly grooved.

Very common in moist, shady as well as open forests throughout the state.

Fertile: February - October.

Distribution: SRI LANKA, INDIA - Throughout India.

Specimens examined; Jamir 7009, 7017, 7960 Changki (Mokokchung dist., 1000 m); 6688 Tejit (Mon dist., 200 m).

Microlepia hookeriana (Wall. ex Hook.) Presl. Epim. 95. 1849; C. Chr., 308. NPfl. 215; Bedd., Handb. Ferns Brit. India 62. t. 32. 1883.

Davallia hookeriana Wall. ex Hook., Sp. Fil. 1: 172. 1846.

(Plate 76)

Rhizome rather stout, creeping, densely covered with pale-brown scales. Stipes 20 - 30 cm long, erect, dark-brown, more or less densely hairy at base, sparsely or glabrous above; lamina 40 - 60 x 15 - 20 cm, pinnate, lanceolate; rachis pale-brown, pubescent; lateral pinnae about 20 - 28 pairs, alternate to subopposite, subsessile, apical pinnae single, elongate, about 10 cm long, basal pinnae gradually shortened, the lowest one about 4 x 1 cm, largest pinnae 10 x 1.5 cm, subpetiolate, lanceolate with a broad, hastate base, gradually acuminate at apex, margin crenate, sparsely hairy on the costa and veins beneath, texture membranous;

veins free, forked. Sori approximate, continual along the line at the base of the crenatures of the margin; indusium half cup-shaped; sporangia stalked; spores globose, pale-brownish.

Rare, in moist shady forests. Occasionally on the rock crevices.

Fertile: October - November.

Distribution: HONGKONG, INDIA - Meghalaya, Assam.

Specimens examined: Jamdr 6602 Mon (Mon dist., 898 m).

√Microlepia marginata (Panzer) C.Chr., Ind. Fil. 212.1905; Baishya & Rao, Ferns & Fern-allies Meghalaya 91. 1982.

Polypodium marginatum Panzer, Pflanzensyst. 13: 199. 1786.

Microlepia marginalis (Thunb.) Bedd., Handb. Ferns Brit. India 64. 1883.

Davallia marginalis Hook. et Baker, Syn. Fil. 98. 1867; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 446.1880.

Rhizome about 0.6 cm across, wide-creeping, hard, covered with whitish, short hairs or tubercles; lamina 30-55 x 25 - 30 cm or more, bipinnate, broadly lanceolate; rachis dark-brown, rough, densely short hairy; lateral pinnae

about 15 - 25 pairs, alternate, petiolate; largest pinnae up to 20 x 30 cm, elongate, oyate-lanceolate, subfalcate, acuminate, obliquely cuneate at base; pinnae crenate to pinnatifid lobate on anterior margin, usually entire on posterior margin, pubescent on ventral surface, dorsal surface rather glabrous; lobes acute, crenate-dentate; costae hairy; texture coriaceous; veins free, forked, prominently raised, villous. Sori subglobose, terminal on the veins, 2- 8 in each pinnule, submarginal, just below the sinuses; indusia broad, halfcup-shaped, covered with short hairs, base cuneate, coriaceous; sporangia brownish, stalked; spores hyaline.

Abundant, in forest cleared areas and also along the river banks and ditches.

Fertile: July - October.

Distribution: JAVA, POLYNESIA, MALAYA, NEPAL, CHINA, TAIWAN, INDIA - Nilgiris, Himalayas, Meghalaya.

Specimens examined: Jamir 6648 Mon (Mon dist., 898 m); 6592 Changki (Mokokchung dist., 1000 m).

Microlepia pilusula (Wall.) Presl, Tent. Pterid. 125. 1836; Baishya & Rao, Ferns & Fern-allies Meghalaya 91. 1982.

Davallia pilusula Wall. (Cat. 263. 1828 nom. nud.).

Davallia polypodioides D. Don, Prodr. Fl. Nepal 10.1825; Clarke, in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 447. 1880.

Rhizome rather stout, short, semierect, apex covered with pale-brown scales. Stipes 25 - 40 cm long, tufted on rhizome; lamina 30 - 60 x 20 - 30 cm, bipinnate to tripinnatifid; rachis densely covered with short, pale-brown hairs; pinnae oblique, alternate, largest pinnae 15 x 5 cm, bearing many, oblique pinnules, largest pinnules up to 3 x 1.5 cm, sessile, margin deeply cut down up to midrib at base, pinnatifid at apex; lobes usually entire or slightly crenate or smaller one nearly oblong; texture coriaceous; costae, costules and veins sparsely covered with short hairs on both surfaces; veins free, forked. Sori dorsal, superficial on veinlets, usually one on each lobe; indusia half cup-shaped, hairy, margin undulating; sporangia oval, slender-stalked, peltate; paraphyses cordate-ovate, hairy; spores pale-yellow, translucent; exine smooth.

Frequent in shady as well as open forests.

Fertile: October - December.

Distribution: MALAYA, INDIA - Meghalaya.

Specimens examined: Jamir 6482 Kohima (Kohima dist., 1445 m); 6368 Shamator (Tuensang dist., 1372 m); 6644 Mon (Mon dist., 898 m).

✓ Microlepia platyphylla (D.Don) J.Smith in J. Bot. London 1: 427. 1842; Bedd., Handb. Ferns Brit. India 66, t. 33. 1883; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim Himalayas 118. 1964; Wang-chueng Shieg in Fl. Taiwan 1: 250. (ed. 2). 1980; Dhir, Ferns N.W. Himalayas 53. 1981; Baishya & Rao, Ferns & Fern-allies Meghalaya 91. 1982.

Davallia platyphylla D. Don, Prodr. Fl. Nepal 10. 1825; Clarke, in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 446. 1880.

(Plate 77)

Rhizome stout, creeping, dorsiventral, densely clothed with dark-brown hairs. Stipes 70 - 100 x 0.5 - 1 cm or more, pale-brown, erect, glabrous, polished; lamina up to 70 - 100 cm long, deltoid-ovate, bipinnate; rachis pale-brown, glabrous; pinnae alternate, petiolate, largest pinnae up to 50 x 25 cm, lanceolate, oblique to the main rachis, petiolate; largest basal pinnule 18 x 6 cm, deltoid lanceolate, base oblique to costae, about 0.8 cm long, stalked, deeply cut down into lobes; lobes oblong-deltoid, margin toothed or crenate, apex acute or round, blunt; texture coriaceous, glabrous, shining on both surfaces; veins free, forked. Sori on the terminus of veinlets, reniform, marginal, placed on each tooth; indusia reniform, margin lobed; sporangia slender-stalked, ciliate at base; spores globose, darkish-brown; exine smooth.

Frequent, in moist, shady forests, sometimes along the slopes and streams on mountains.

Fertile: July - October.

Distribution: CHINA, SRI LANKA, NEPAL, BURMA, TAIWAN, PHILIPPINES, BHUTAN, INDIA - throughout western ghats, and Meghalaya.

Specimens examined: Jamir 6141 Phek (Phek dist., 1200 m); 6390 Mezenkong (Mokokchung dist., 1326 m).

Microlepia puberula vAvR., in Bull. Jard. bot. Buit. 2, 11: 17. 1913; Holttum, Fl. Malaya 2: 312. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 92. 1982.

Davallia flaccida R. Br., Prodr. Fl. N. Holl. 157. 1810; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 448. 1880 pro parte.

Rhizome rather stout, creeping, densely covered by dark-brown, shining scales. Stipes 40 - 70 xm long, stout, covered with short, pale-brown hairs; lamina 50 - 100 x 25 - 40 cm, bipinnate to tripinnatifid, broadly lanceolate, acuminate, lower surface densely covered throughout with short hairs, upper surface sparsely hairy; rachis and costae puberulous throughout; pinnae numerous, alternate, rachis, shortly petiolate, the lowest pinnae somewhat reduced;

largest pinnae 25 x 10 cm, deltoid-lanceolate, oblique to the rachis; pinnules up to 9 x 3 cm, largest shortly stipitate (about 1 cm long), base unequal, apex lanceolate acuminate (or blunt on small pinnae), margin deeply lobed, sessile; leaflets or lobes 2 x 1 cm, oblique to the costules, basal ones on the acroscopic side larger than the rest, elliptic-oblong, apex rounded, crenate or lobed, texture herbaceous; veins free, forked. Sori up to 0.2 cm long, superficial, nearly marginal to lobes, on the tip of veinlet, a single in each lobe on acroscopic side; indusia elliptical, margin lobed, bearing many, short hairs. Sporangia oval, paraphyses peltate; spores triangular, bright yellow; exine smooth.

Frequent in moist, shady forests.

Fertile: October - December.

Distribution: MALAYA, INDIA - Meghalaya.

Specimens examined: Jamir 6490, 6491 Kohima (Kohima dist., 1445 m); 6341 Morong forest (Tuensang dist., 2136 m).

✓ Microlepia speluncae (Linn.) Moore, Ind. Fil. 43. 1857; Bedd.,Ferns Brit. India 67. 1883; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim Himalayas 117. 1964; Holttum, Fl. Malaya 2: 314. 1968; Iwatsuki in Fl. East. Himal. (3 Rep.) 175. 1975; Baishya & Rao, Ferns & Fern-allies Meghalaya 92. 1982.

Polypodium speluncae Linn., Sp. Pl. 1555. 1753.

Rhizome rather stout, creeping, covered with short, pale hairs. Stipes 35 - 50 x 0.4 - 0.8 cm or more, purplish-green, short-hairy throughout; lamina 50 - 80 x 30 - 45 cm, tripinnate consisting of many, alternate pinnae, petiolate, the basal one usually slightly reduced than the rest; rachises more or less densely shortly-hairy; largest pinnae up to 25 x 6 cm, ovate-lanceolate, pinnatifid at apex, petiolate (about 1 cm long), largest pinnule up to 7 x 2.5 cm, narrowly deltoid, pinnate at base, lobed nearly to the costa, the basal acroscopic leaflet much larger than the rest, shortly stalked; ultimate pinnules or leaflets about 1 x 0.6 cm, more or less oblique to the costules, distantly spaced or touching each other, apex bluntly rounded, edges deeply lobed in the larger ones, crenate in the smaller; texture thin, soft, costae and costules hairy; veins hardly raised, more or less densely hairy. Sori submarginal, near the base of the sinuses between the lobes; indusia elliptical to cup-shaped, with few to many hairs; margin finely lobed; sporangia copious; spores yellowish-brown; exine minutely grooved.

Frequent in moist, shady forests.

Fertile: October.

Distribution: CHINA, SRILANKA, MALAYA, TAIWAN, POLYNESIA, TROPICAL AMERICA, JAPAN, BANGLADESH, INDIA - Western ghats, Himalayas and Meghalaya.

Specimens examined: Jamir 6679 Tejit (Mon dist., 100).

Microlepia speluncae (Linn.) Moore var. hancei (Prantl) C.Chr. et Tard-Blot, Not. Syst. 6: 9. 1937.

M. hancei Prantl, Arb. Bot. Gart. Breslau 1: 35. 1892.

Rhizome up to 2 cm thick, stout, wide-creeping, apex covered with short, pale-hairs. Stipes 40 - 60 x 1 - 1.5 cm, erect, pale-purplish when dry, shining, glabrous or very shortly hairy; lamina 60 - 100 cm long, tripinnate, the basal pinnae reduced; rachis pale-brown, covered with more or less short-hairs, largest pinnae 20 - 55 x 12 - 18 cm, petiolate, basal acroscopic pinnule usually largest; largest pinnules 12 x 3 cm, narrowly deltoid acuminate, petiolate (about 0.2 cm long), deeply cut down into many leaflets; leaflets and lobes up to 2 x 1 cm, more or less oblique, well spaced, unequal at base, apex rounded, edges deeply lobed in the larger ones, crenate; texture thin, soft; costae, costules and veins short-hairy on both surfaces; veins free, forked, hardly raised. Sori near the base of the sinuses between the lobes, more or less opposite; indusia rather large, elliptical to half cup-shaped, hairy, usually covered with spreading sporangia, sometimes not hidden at maturity; spores yellowish-brown; exine finely grooved.

Frequent in moist, shady forests; sometimes near rivers and streams.

Fertile: May - October.

Distribution: MALAYA, INDIA - Meghalaya.

Specimens examined: Jamir 6679 Tejit (Mon dist., 200 m).

This variety differs from the type in having very few hairs on veins.

√Microlepia strigosa (Thunb.) Presl, Epim. Bot. 95. 1849; Bedd., Handb. Ferns Brit. India 67. 1883; Nayar et Kaur in Bull. nat. bot. Gard. Lucknow 79: 16. 1963; Holttum, Fl. Malaya 2: 310. 1968; Iwatsuki in Fl. East. Himal. (3 Rep.) 175. 1975; Wang-chueng Shieg in Fl. Taiwan 1: 251. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 92. 1982.

Trichomanes strigosum Thunb., Fl. Jap. 339. 1784.

(Plate 78)

Rhizome 0.3 - 0.6 cm thick, rather stout, wide-creeping densely covered with ferruginous, fibrillose hairs; hairs about 0.2 cm long; stipes 25 - 60 x 0.3 - 0.6 cm, erect, stout, rather rough hairy at base, pale-dark, glossy, glabrous or shortly hairy above; lamina 35 - 60 x 15 - 30 cm, bipinnate to tripinnate, ovate, the lowest 1 - 2 pairs of pinnae slightly reduced, thinly membranous, glossy green,

densely covered with white silky hairs; rachis densely short-hairy, pinnae numerous, alternate; largest pinnae up to 25 x 5 cm, petiolate (about 0.4 cm long), lanceolate-acuminate, cut down to the rachis giving rise to pinnules; the pinnules shortly petiolate, touching each other or even slightly overlapping at their bases; largest pinnules 2 x 0.7 cm, oblong, sessile or subsessile, oblique to the costa, base cuneate, densely hairy, the lowest basal pinnule usually touching the main rachis; lobes contiguous, rounded, crenate; texture firm; veins strongly raised below, bearing stiff, curved hairs. Sori subglobose, depressed, submarginal solitary on each pinnule; indusium broadly cup-shaped, membranous, small, bearing few hairs.

Common, grows in moist, shady as well as open forests.

Fertile: July - October.

Distribution: CHINA, SRILANKA, MALAYA, JAPAN, TAIWAN, PHILIPPINES, POLYNESIA, INDIA - South India, Himalayas and Meghalaya.

Specimens examined: Jamir 6089, 6125 Kohima (Kohima dist., 1445 m); 6236 Phek (Phek dist., 1200 m); 6415,6416 Tejit (Mon dist., 200 m); 6639 Mon (Mon dist., 898 m).

Microlepia trapeziformis (Roxb.) Kuhn. Chaetopt. 347. 1882; Holttum, Fl. Malaya 2: 313. 1954; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim Himalayas 117. 1964; Wang-chueng Shieg in Fl. Taiwan 1: 252. (ed. 2). 1980; Baishya, & Rao, Ferns & Fern-allies Meghalaya 93. 1982.

Davallia trapeziformis Roxb. in Calc. J. 4: 516. 1884; Microlepia rhomboidea Presl, Tent. Pterid. 125. 1836 nom. nud.).

(Plate 79)

Rhizome 0.5 cm across, creeping, densely covered by ferruginous, septate hairs. Stipes 30 - 60 x 0.2 - 0.4 cm, glabrescent, purplish-brown; lamina 25 - 50 x 15 - 30 cm, quadri-pinnatifid at base, and tripinnatifid towards apex, ovate or ovate-oblong; rachis purplish-brown, glabrescent, covered with short hairs; lateral pinnae 25 - 30 pairs, rather oblique, alternate, petiolate; largest pinnae 30 x 10 cm, oblanceolate, petiolate, bearing many, oblique, alternate pinnules, the lowest somewhat longer than the others; largest pinnule 5 x 3 cm, rather oblique to costa, narrowly deltoid, petiolate, ultimate pinnules or leaflets well spaced, alternate, oblique to costule, the largest up to 10 lobes; the lobes elliptic to obovate, entire, or the smaller one nearly oblong; texture firm, herbaceous, veins free, much forked, bearing sparse, stiff, curved, pale hairs. Sori globose, usually one on each lobe, near the sinuses,

4 - 8 in each leaflet; indusium half cup-shaped, hairy; spores dark, hyaline; exine spinulose.

Abundant, in moist, open places and also along roadsides on hills.

Fertile: October - December.

Distribution: CHINA, MALAYA, TAIWAN, PHILIPPINES, INDIA - Himalayas, Meghalaya.

Specimens examined: Jamir 6387 Mezenkong (Mokokchung dist., 1326 m); 6389 Kohima (Kohima dist., 1445 m).

3. Monachosorum

Kuntze, Bot. Zeit. 6: 119. 1848; C. Chr., Ind. Fi. 430. 1906; Copel., Gen. Fil. 51. 1947.

Terrestrials. Rhizome short, ascending, covered with minute, clavate, brown hairs. Stipes slender, tufted, firm, shining, glabrous; lamina simple pinnate to quadripinnate; ultimate pinnules lobed or incised, each lobe with a single veinlet, which falls short to its tip, glabrous, dark to greenish, membranous; veins free. Sori terminal or nearly so on the veinlets, roundish, small, exindusiate; sporangia mixed with glandular paraphyses, short-stalked, annulus of 14 - 20 thick walled cells; spores tetrahedral, muriculate.

A genus of 7 species; 1 in Nagaland.

Monachosorum subdigitatum (Blume) Kuhn, Chaetopt. Polypod. 345. 1882; Baishya & Rao, Ferns & Fern-allies Meghalaya 95. 1982.

Polypodium subdigitatum Blume, Enum. Pl. Jav. 196, t. 93, 1828; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 546. 1880.

(Plate 80)

Rhizome short ascending, densely covered with broad, ovate, entire, membranous scales. Stipes 50 - 100 cm long, tufted, firm, shining, glabrous or furfuraceous; lamina large, up to 150 cm long, broad, lanceolate to deltoid-acuminate, quadripinnate, largest primary pinnae about 25 - 45 x 20 - 30 cm, opposite, more or less at right angles to the main rachis, broad, deltoid-acuminate in outline, petiolate; pinnae about 0.7 cm long; secondary pinnae (pinnules) up to 20 x 6 cm, elliptic, oblanceolate, stalked, tertiary pinnae up to 5 x 2.5 cm, pinnatifid, usually pinnate at base; the lower lobes incised, the upper ones usually entire; rachis and costae pale-brown, glabrous or furfuraceous; texture thin, membranous, drying greenish, glabrous; veins simple, once or twice forked, blackish, depressed. Sori small, at the apex of the veinlets, round, dark-brown; sporangia short-stalked; spores oval, dark; exine spinulose.

Frequent, in dense forests; sometimes in open slopes of hills.

Fertile: May - December.

Distribution: MALAYA, NEPAL, BHUTAN, INDIA - Himalayas up to 1827 -2144 m elevations; Meghalaya.

Specimens examined: Jamir 6473, 7153 Kohima (Kohima dist., 1445 m).

27. HYPOLEPIDACEAE

Terrestrials. Rhizome wide-creeping, often profusely branched, clothed with reddish, pluricellular hairs or rarely narrow castaneous paleae; vascular cylinder solenostelic to dictyostelic. Stipes erect, strigose, continuous with rhizome; lamina pinnately decompound, hairy, often glabrous, herbaceous; veins free or united together by an intramarginal vein or reticulate with elongated areoles, devoid of included veinlets. Sori globose, usually marginal protected by reflexed margin of the lamina or away from margin and quite unprotected; inner indusia lacking or minute; sporangia with slender, elongate stalks; annulus of 10 - 20 thick walled cells; spores bilateral, monolete or trilete; rarely smooth, exine granulose to tuberculate; perine absent.

A family of 6 genera; 3 in Nagaland.

K E Y T O G E N E R A

1a. Sori continuous along the margin of lamina.

2a. Veins anastomosing; inner indusium lacking . . . . . Histiopteris

2b. Veins free; inner indusium present . . . . . Pteridium

1b. Sori singly, terminal on a vein, not continuous along the edges of lamina . . . . . Hypolepis

Hypolepis

Bernth., Schrad. nell. J. 1: 34. 1805; C. Chr., in Ind. Fil. 370. 1906; Copel. Gen. Fil. 57. 1947.

Rhizome long-creeping, clothed with brownish-hairs; solenostelic; fronds bipinnate to compound, hairy or glabrous, herbaceous; veins free. Sori submarginal, protected by reflexed margin of the lamina, sometimes intramarginal and naked, terminal on the veins; sporangia stalked; spores bilateral, spinulose to tuberculate, sometimes smooth.

Species : about 50; 1 in Nagaland.

Hypolepis punctata (Thunb.) Mett. ex Kuhn. Fil. Afr. 12. 1868; Bedd., Handb. Ferns Brit. India 19. 1883; Holttum, Fl. Malaya 2: 318. 1968; Iwatsuki in Fl. East. Himal. (3 Rep.) 174. 1975; Wang-chueng Shieg in Fl. Taiwan 1: 245 (ed.2). 1980; Dhir, Ferns N.W. Himalayas 55. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 89. 1982.

Polypodium punctatum Thunb., Fl. Jap. 337. 1784.

(Plate 81)

Rhizome slender, long-creeping, short hairy or strigose. Stipes 20 - 40 x 3 - 5 cm, erect, pale-brown, short hairy, lamina 25 - 60 cm long or more, deltoid-ovate, bipinnate to tripinnate, herbaceous; the larger lower pinnae opposite, the smaller upper ones usually alternate; largest pinnae 15 - 45 cm long, oblique to the main rachis, deltoid, upper pinnae gradually narrowed, deltoid; pinnules oblique to the pinnae-rachis; largest basal pinnules 5 - 15 x 2 - 6 cm, ultimate pinnules or leaflets of third order up to 4 x 1.5 cm, lobed to crenate, apex obtuse or rounded. Sori terminal on a vein, usually covered or partly covered by reflexed marginal flap, often quite exposed; spores elliptical to bean-shaped, yellowish-brown, hyaline; exine smooth or tuberculate.

Abundant, in open places and along roadsides.

Fertile: August - November.

Distribution: CHINA, SRILANKA, MALAYA, S. KOREA, JAPAN, TAIWAN, INDIA - N.W. Himalayas, Meghalaya.

Specimens examined: Jamir 6392, 6379 Mezenkong (Mokokchung dit., 1300 m); 6425, 6405 Mensa (Mokokchung dist., 1300 m); 6508 Wokha (Wokha dist., 1314 m).

Pteridium

Gledistsch, ex Scop., Fl. Carn. 169. 1760 (nom. cons.); C. Chr., Ind. Fil. 591. 1906; Copel., Gen. Fil. 59. 1947.

Terrestrials. Rhizome long creeping, clothed with hairs. Fronds tripinnate to quadripinnatifid, subcoriaceous, more or less hairy; veins free. Sori linear, submarginal or marginal, borne on the connecting vein; indusia double, the outer (false) ones formed by reflexed margin, the inner (true) ones developed or absolescent; annulus of 12 - 17 thickened cells; spores tetrahedral, papillose.

A genus with about 6 - 8 species; 1 in Nagaland.

Pteridium aquilinum (Linn.) Kuhn. in Von der Decken Reisen in Ost-Afrika 3 (3): 11. 1879; Holttum, Fl. Malaya 2: 389. 1968; Iwatsuki in Fl. East. Himal. (3 Rep.) 176. 1975; Wang-chueng Shieg in Fl. Taiwan 1: 255 (ed. 2). 1980; Dhir, Ferns N.W. Himalays 54.

1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 107. 1982.

✓Pteris aquilina Linn., Sp. Pl. 1075. 1753; Bedd., Handb. Ferns Brit. India Suppl. 115. 1892.

Pteridium aquilinum subsp. typicum Tryon in Rhodora 43: 15. 1941.

(Plate 82)

Rhizome wide creeping; hypogeal, about 1 cm thick, densely clothed with fine, pale-brown hairs; scales absent. Stipes 20 - 60 cm or more long, solid, stout, glabrous above, hairy at base; lamina up to 60 cm long or more, deltoid-ovate, bipinnate to tripinnate, herbaceous or subcoriaceous, glabrous or sparsely hairy beneath; lower pinnae large, opposite or subopposite, upper pinnae smaller, usually alternate; largest pinnae (basal pinnae) 20 - 60 x 10 - 30 cm, deeply bipinnate to tripinnatifid; rachises hairy but almost glabrous beneath; largest ultimate pinnule (leaflet) up to 18 x 4 cm, pinnatifid to bipinnatifid, cut almost or quite to the costa, oblong, apex obtuse or entire; segments contiguous, more or less falcate, sometimes crenate at base, apex rounded or obtuse. Costules and veins raised below, densely hairy; veins free, simple or forked. Sori copious, continuous along the margin of segments; indusia inconspicuous; sporangia slender stalked; spores tetrahedral, pale-brown.

Very common almost all over the state usually in slopes of open areas and along roadsides.

Fertile: July - November.

Distribution: CHINA, JAPAN, SRILANKA, TAIWAN, NORTH AMERICA, EUROPE, INDIA - N.W. Himalayas, Meghalaya, Assam.

Specimens examined: Jamir 6429 Zenheboto (Zenheboto dist., 2045 m); 6409, 6633 Mon (Mon dist., 898 m); 6226 Changki (Mokokchung dist., 1000 m); 6057 Peren (Kohima dist., 1446 m); 6303 Shamator village (Tuensang dist., 1372 m).

Histiopteris

(Ag.) J.Smith, Hist. Fil. 295. 1875; C. Chr., Ind. Fil. 352. 1906; Copel. Gen. Fil. 60. 1947.

Terrestrials. Rhizome long-creeping, clothed with narrow scales, solenostelic. Fronds large, of indefinite length; pinnate to bipinnate, with a reduced pair of stipule-like basal pinnules; pinnae opposite, firm to coriaceous, glabrous, often glaucous; veins anastomosing without included, free veinlets. Sori linear, submarginal or continuous along the margin, connecting vein protected by a scarious, reflexed false indusium; annulus of 10 - 18 thickened cells; freely paraphysate; sporangia slender stalked; spores tetrahedral, tuberculate, pale -brown, translucent.

A genus with about 7 species; 1 in Nagaland.

Histiopteris incisa (Thunb.) J. Smith, Hist. Fil. 290. 1875; Holttum, Fl. Malaya 2: 391. 1968; Wang-chueng Shieg in Fl. Taiwan 1: 243. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 108. 1982.

Pteris incisa Thunb. Prodr. Fl. Cap. 171. 1800; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 471. 1880.

Litobrochia incisa (Thunb.) Presl, Tent. Pterid. 149. 1836; Bedd., Handb. Ferns Brit. India 120, t. 62. 1883.

(Plate 83)

Rhizome long-creeping, clothed with dark-brown, linear scales. Stipes up to 65 x 0.3 - 1.2 cm, shining, purplish, glabrous, polished; lamina up to 100 cm or more long, bipinnate to tripinnate; pinnae and pinnules opposite, well spaced; pinnae of larger fronds usually 60 x 30 cm, distant, sessile with pairs of pinnules spaced 6 cm apart; pinnules opposite, sessile, lanceolate, up to 18 x 6 cm, cut down almost or quite to the costa, lobes bluntly triangular, pinnatifid at apex; lowest pinnules much smaller and shorter, stipule-like at the base of the pinnae or very near to the rachis, up to 4.5 x 1.5 cm, more or less deeply lobed; veins depressed, reticulate. Sori linear, marginal, yellowish-brown; sporangia slender stalked; annulus of 18 thickened cells; spores bilateral.

Not common, along roadsides and slopes of forest cleared areas.

Fertile: July - November.

Distribution: TROPICS AND SUBTROPICS OF AMERICA, AFRICA, AUSTRALIA, POLYNESIA, STRILANKA, BHUTAN, INDIA - Central and Southern India, Sikkim and Khasi hills up to 2000 m

Specimens examined: Jamir 6404 Changki (Mokokchung dist., 1000 m); 6194 Khensa (Mokokchung dist., 1326 m).

28. LINDSAEACEAE

Terrestrials, rarely epiphytes. Rhizome creeping, slender, protostelic or solenostelic, covered with narrow scales or brislte-like hairs and basally attached palea or both. Stipes with 1 or 2 vascular strands, not articulate to rhizome. Fronds pinnately divided, sometimes very finely, or in few cases simple; veins free or anastomosing without free, included veinlets. Rachis deeply grooved on upper surface; basioscopic margin of the pinnae decurrent on the edges of the rachis, costae of leaflets not raised. Sori marginal or submarginal, terminal on the veins, simple (on apices of separate veins) or united to form coenosori of varying length; indusium well developed, attached on the basal side of the sorus and opening towards the margin, in some cases attached by its sides as well as base; sporangia

with 2 - 3 rows of cells, stalked, dehiscing by transverse slits; annulus 12 - 18-thick walled cells, incomplete, vertical; spores trilete or monolete, tetrahedral, persistent; exine smooth or granulose, sometimes spinulose.

A family with about 9 genera; 2 genera represented in Nagaland.

K E Y T O G E N E R A

Fronds finely divided; ultimate segments connected with each other by wings; sori solitary at the terminus of each segment .. .... 1. Sphenomeris

Fronds otherwise; sori many on each leaflet or more or less continuous along the margin . . . . . 2. Lindsaea

1. Sphaenomeris

Maxon in J. Washington Acad. Sci. 3: 144. 1913; Copel. Gen. Fil. 54. 1947.

Terrestrials. Rhizome short-creeping, protostelic, covered with dark-brown, dense, hair-like scales; scales up to 0.3 cm long. Stipes grooved at adaxial surface. Fronds finely dissected, bi or tripinnatifid, ultimate segments or pinnules cuneate, glabrous; veins dichotomously forked, free.

Sori terminal on a vein or often on a union of 2 or 3 veins to the apex of the lobe; indusium attached basally or a little above the base, the rest free, opening towards the margin; annulus of 10 - 20 thickened cells; spores bilateral, without perispore.

About 20 species mostly in pantropic, South to New Zealand and Madagascar, North to Japan and Florida; only 1 species in Nagaland.

Sphenomeris chinensis (Linn.) Maxon in J. Washington Acad. Sci. 3: 144. 1913.

Trichomanes chinensis Linn., Sp. Pl. 1099. 1753.

Adiantum chusanum Linn., Sp. Pl. 1095. 1753.

Stenoloma chinensis Bedd., Handb. Ferns Brit. India 70, t. 34. 1883.

Sphenomeris chusana (Linn.) Copel., in Bishop Mus. Publ. 52: 69. 1929; Holttum Fl. Malaya 2: 341. 1954; Baishya & Rao, Ferns & Fern-allies Meghalaya 97. 1982.

(Plate 84)

Rhizome stout, short-creeping or semierect, covered with hair-like scales, about 0.2 cm long, dark-brown, stiff. Stipes up to 60 x 0.1 - 0.3 cm, glabrous, stamineous, adaxially grooved. Lamina 15 - 50 x 6 - 20 cm, tripinnate or quadripinnatifid, lanceolate or ovate, herbaceous; lower pinnae ovate-lanceolate, 8 - 15 x 5 - 8 cm; pinnules rhomboidal, oblique, deltoid, lanceolate, 2 - 4-lobed on

each pinnule, the segments cut down to the rachis, lobes toothed, cuneate; veins 2 - 3 in each lobe, apices jointed by a sorus. Sori marginal or submarginal with 1 - 3 terminal veinlets, usually solitary; indusium attached basally or a little above the base, the rest free, open outwards; annulus 10 - 20-celled; spores bilateral, hyaline, brown, perispore absent.

Very common in forest cleared areas and along road sides on hills.

Fertile: July - December.

Distribution: MADAGASCAR, POLYNESIA, JAPAN, MALAYA, BHUTAN, INDIA.

Specimens examined: Jamir 6240 Mepungchuket (Mokokchung dist., 1300 m); 6621 Mon (Mon dist., 898 m); 6078 Kohima (Kohima dist., 1445 m); 6046 Peren (Kohima dist., 1446 m); 7914 Zenheboto (Zenheboto dist., 1875 m).

2. Lindsaea

Dryander ex Smith, Mem. Acad. Sci. Turin, 5: 413. 1793; C. Chr. Ind. Fil. 391. 1906; Copel. Gen. Fil. 52. 1947.

Terrestrials. Rhizome slender, creeping or climbing, protostelic or solenostelic, clothed with brown, hair-like scales. Stipes slender, grooved on the adaxial surface; vascular strands simple. Fronds pinnate or bipinnate; glabrous or finely pubescent; rachilla always grooved on the uppper surface, with narrow raided edges; pinnae oblique, lower margin nearly straight and entire, upper margin lobed; veins free or dichotomous, without distinct rib, Sori submarginal, terminal on single veins; indusium a narrow flap attached along the base of the receptacle, opens towards the margin of lamina; annulus of 9 - 17 thickened cells; spores pale, tetrahedral, sometimes bilateral, smooth or minutely warty.

A large genus with about 200 species mostly pantropic, South to New Zealand, Tasmania, Taiwan and Natal; 3 species in Nagaland.

K E Y T O S P E C I E S

1a. Pinnae elongate, 10 - 15 cm long, not dimidiate . . . . . ensifolia

1b. Pinnae 2 - 3 cm long, dimidiate.

2a. Pinnae shortly stalked, 3 - 7 lobed on the upper margin . . . . . cultrata

2b. Pinnae sessile or lower very shortly stalked, entire or 1 - 2 lobed on the upper margin . . . . . himalaica

✓Lindsaea cultrata (Willd.) Sw., Syn. Fil. 119. 1806; Bedd., Handb. Ferns Brit. India Suppl. 72, t. 36. 1892; Holttum, Fl. Malaya 2: 328. 1968; DeVol Fl. Taiwan 1: 260. (ed. 2). 1980.

Adiantum cultratum Willd., in Phytogra. 14, t. 10. f. 2, 1794.

Lindsaea odorata Roxb. in Calc. J. nat. Hist. 4: 511. 1844; Kramer in Blumea 15: 567. 1968.

L. lobbiana Hook., Sp. Fil. 1: 205. t. 62C. 1884; Bedd., Ferns Brit. India t. 28. 1865.

Rhizome short-creeping, sometimes branched, scaly; scales hair-like, brown, narrow, up to 0.3 cm long. Stipes up to 20 cm long, ridged, glabrous, pale-brown or nearly black, quadrangular in cross section. Fronds 5 - 30 x 1 - 3.5 cm, glabrous, sometimes pubescent. Lamina simple pinnate or bipinnate by development of 1 - 2 pairs of lateral pinnae; pinnae shortly stalked, the lower edge straight, the upper edge with 3 - 7, rounded or truncate lobes, each lobe, again clefted at apex. Veins dichotomous to each lobe,

free, joined to the sori, hardly visible on lower surface, but distinct on upper surface. Sori terminal, one on each lobe, ending on more than 2 veinlets; indusium firm, entire, reaching the margin of lamina, opens outwards, margin toothed. Spores globose, kidney-shaped or roundish, grooved.

Frequent, usually grows along streams in hilly areas.

Fertile: July - November.

Distribution: CHINA, MALAYA, TAIWAN, PHILIPPINES, SRILANKA, JAPAN, AUSTRALIA, EAST AFRICAN ISLANDS, BURMA, NEPAL, BANGLADESH, INDIA.

Specimens examined: Jamir 7217 Changki (Mokokchung dist., 1000 m).

✓ Lindsaeae ensifolia Sw., Schrad. J. Bot. 1800, 2: 77. 1801; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 452. 1880; DeVol Fl. Taiwan 1: 58 (ed. 2). 1980. Schizoloma ensifolia (Sw.) J. Smith in J. Bot. 3: 414. 1841.

Rhizome short-creeping, stout; scales narrow, brown, up to 0.2 cm long. Stipes 10 - 30 x 0.1 - 0.2 cm, ridged, glabrous, pale brown, quadrangular. Lamina 10 - 30 x 8 - 25 cm, simple pinnate with 2 - 7 pairs of lateral pinnae, glabrous, herbaceous; pinnae 5 - 25 x 0.5 - 3.5 cm, cuneate

at base, short stalked, linear-acuminate or lanceolate; sterile pinnae toothed; veins free, reticulate. Sori linear, brown, continuous along both margins except at extreme tip; indusium linear, firm, entire, continuous with margins; spores globose, roundish.

Common along roadsides in open places; sometimes on rock crevices.

Fertile: February - July.

Distribution: SRI LANKA, NORTH AUSTRALIA, TROPICAL AFRICA, BANGLADESH, POLYNESIA, BURMA, INDIA - South India, Himalayas , Sikkim and Meghalaya.

Specimens examined: Jamir 7060, 7059 Changki (Mokokchung dist., 1000 m).

Lindsaea himalaica Kramer in Gard. Bull. Singap. 26: 43. 1972; Nair & Dixit in J. Bomb. nat. Hist. Soc. 78: 455. 1981.

Lindsaea cultrata (Willd.) Sw. var. assamica Hook. Sp. Fil. 1: 204. 1846.

(Plate 87)

Rhizome short-creeping, wiry, scaly; scales dark-brown, linear, hair-tipped, up to 0.1 cm long. Stipes 1.5 - 5 cm long, tough, dark-brown, glabrous except the scaly base; lamina up to 8 x 2 cm, slender, oblong, simple pinnate;

lateral pinnae up to 15 pairs, alternate; nearly half of the lower pinnae shortly stalked, the rest above sessile; largest pinnae up to 0.7 x 1.2 cm, the upper margin up to 3 shallowly lobed, lower margin entire; veins obscure, glabrous on both surfaces; dark-greenish when dry; sori terminal, one on each lobe, indusia greenish-brown, firm, entire, arranged at the upper margin of lamina, open outwards, margin toothed; spores globose or round.

Rare; grows on humus and moss-covered rocks along streams and water courses.

Fertile: February.

Distribution: INDIA - Assam, Himachal Pradesh, and Manipur.

Specimens examined: Jamir 7037 Changki/Longaakza (Mokokchung dist., 450 m).

29. THELYPTERIDACEAE

Terrestrials. Rhizome usually creeping, ascending or erect, dictyostelic; rhizome scales usually rigid, not peltate, sometimes bearing glandular or setose hairs on the margins or often on surface. Stipe not articulate to rhizome; vascular bundle two, uniting above, forming 'U'-shaped bundle in the upper part; rachis and costae covered with setose or glandular hairs, midrib grooved. Lamina usually oblong or elliptic in outline (not deltoid), simple pinnate to tripinnate. Veins all free or forked, Sori dorsal, superficial, usually subapical on the veins, round to elongate; indusia reniform, often vestigeal or rarely absent; sporangia long stalked, usually with glandular hairs and spherical, sessile glands, often setose (acicular hairs); spores bilateral, rarely trilete, with perispores.

A large family with about 32 genera; 15 in Nagaland.

K E Y T O G E N E R A

Adopted from Holttum (1971).

1a. Rachis with many proliferating buds; unicellular hairs on rachis often forked . . . . . 1. Ampelopteris

1b. Rachis without proliferating buds; hairs not forked.

2a. Midrib of pinnae not grooved on the dorsal surface; veins forked, not reaching up to the margins.

3a. Scales on axes of fronds sparse, not ending in acicular hairs.

4a. Fronds mostly bipinnate; sori exindusiate; exine of spores raised, reticulate . . . 2. Pseudophegopteris

4b. Fronds simple pinnate; sori indusiate; exine of spores otherwise . . . . . 3. Metathelypteris

3b. Scales on axes of fronds otherwise, ending in acicular hairs; fronds bipinnate . . . 4. Macrothelypteris

2b. Midrib of pinnae grooved on dorsal surface; veins simple, reaching the margin and joining with other veins.

5a. Lower pinnae not or very slightly reduced; glandular hairs on lower surface of veins and sporangial stalks lacking.

6a. Rhizome long-creeping.

7a. Veins anastomosing; sporangial stalks with glandular hairs .5. Cyclosorus

7b. Veins free, forked, sporangial stalks without glandular hairs. . .. 6. Thelypteris

6b. Rhizome erect or very short creeping.

8a. Veins free.

9a. Lower surface of fronds with hooked hairs . . . . . 7. *Cyclogramma*

9b. Hooked hairs lacking.

10a. Spores with translucent wings.

11a. Rhizome slender . . . . 9. *Parathelypteris*

11b. Rhizome robust, bearing many roots . . . . 10. *Coryphopteris*

10b. Spores with numerous, broad, dark irregular warts or ridges . 11. .... 11. *Amphineuron*

8b. Veins anastomosing.

12a. Pinnae deeply lobed; spores dark, irregularly tuberculate . . . . 11. *Amphineuron*

12b. Pinnae lobed less than 1/2 way to costa; spores pale, winged or minutely papillose.

13a. Spores trilete . . . . . 8. *Trigonospora*

13b. Spores monolete . . . . .12. *Pronephrium*

5b. Lower pinnae gradually or abruptly reduced; sporangial stalks often with unicellular hairs.

14a. Sporangial stalks with cylindric, unicellular hairs; sessile spherical glands lacking; sporangia never setose; lower pinnae gradually reduced . . 13. *Christella*

14b. Sporangial stalks without such hairs; sessile spherical glands present or absent.

15a. Basal stipe scales broad, thin; surface of lamina fistular, often with short, capitate hairs; spherical glands on sporangia lacking . . 14. Pneumatopteris

15b. Basal stipe scales narrow, hairy; surface of lamina rarely fistular; spherical glands on sporangia present.

16a. Lower surface of fronds provided with hooked hairs . . . . . 7. Cyclogramma

16b. Lower surface without hooked hairs.

17a. Sporangia short stalked or sessile, no glands near annulus.

18a. Rhizome slender, long creeping . . . . . 9. Parathelypteris

18b. Rhizome erect . . 10. Coryphopteris

17b. Sporangia long, slender stalked, glands or setae present near annulus.

19a. Reduced pinnae very few; spores dark, irregularly tuberculate . . . 11. Amphineuron

19b. Reduced pinnae many; spores light brown, spinulose, rarely with a thin wing . . . . . 15. Sphaerostephanas

1. Ampelopteris

Kunze, Bot. Zeit. 6: 114. 1848; Copel. Gen. Fil. 143.1947; Holttum in Blumea 19: 25. 1971.

Stems short-creeping. Fronds usually of indefinite apical growth, bearing many buds on rachis or axils of pinnae which give rise to new plants; rachis slender, covered with forked, unicellular hairs; lamina pinnately compound; basal few pairs of pinnae gradually reduced, pinnae usually wide spaced on rachis; veins almost all anastomosing with few residual free ones running to the margin of pinnae. Sori exindusiate; stalk of sporangia bearing a multicellular, terminal-glandular hair.

Only 1 species widely distributed throughout the world.

Ampelopteris prolifera (Retz.) Copel., Gen. Fil. 143. 1947; Holttum, Fl. Malaya 2: 298. 1954; Chandra & Nair in Proc. Ind. Acad. Sci. 68: 25 - 36. 1968; Dhir, Ferns N.W. Himalayas 105. 1980; Chingmeng-Kuo, Fl. Taiwan 1: 402 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 78. 1982. (Plate 87A).

Rhizome up to 1 cm across, creeping apical part densely covered with ovate, dark-brown, lanceolate scales. Stipes about 15 - 35 cm or more long, grooved, glabrous; rachis bearing numerous dormant vegetative buds which give rise to long secondary fronds. Fronds up to 120 cm or more long, simple pinnate, slightly dimorphic; sterile fronds with flagelliform tips which appear to be of indefinite growth. Fertile fronds developing a terminal pinna; pinnae numerous, well spaced on rachis, alternate or subopposite, subsessile except for the terminal one, base truncate to cordate, blunt or acuminate at apex, margin cut down about 1/4 - 1/8 of way to costa into lobes or crenate (or nearly entire when young); pinnae up to 4 - 20 x 1 - 2 cm, or more; texture thin, subcoriaceous, usually glabrous, dark-brown when dry; grooved on the adaxial side of petioles and rachis, clothed with numerous unicellular or multicellular hairs with glandular tip; acicular hairs borne on the upper surface of costae; the lower surface of lamina sparsely clothed with small, thin broad scales; veins 7 - 8 pairs anastomosing with adjacent opposite costules forming an excurrent, closed veinlet; excurrent veins rarely free and only a few veins in each lobe run to the contiguous margin. Sori elongate-oblong along the distal part of veins, dorsal, superficial; indusia absent; capitate orange coloured paraphyses present, sporangia short stalked, bearing one or more trichomes; annulus of 12 - 19 cells, vertical, spores bilateral, monolete, plano-convex in lateral view, ovate in polar view; exine thick, smooth, densely spinulose.

Very common and highly variable; grows along water courses, ditches and wet grounds in lowlands; sometimes it forms large pure populations; one of the difficult weeds to eradicate.

Fertile: July - February.

Distribution: Old world tropics; AFRICA, ASIA, AUSTRALIA, POLYNESIA, TAIWAN, MALAYA, PHILIPPINES, CHINA, INDIA - Throughout the Indian region in lower elevation.

Specimens examined: Jamir 6565 Chumuketema (Kohima dist., 250 m); 6035 Rangapar forests (Kohima dist., 500 m); 7072 Changki (Mokokchung dist., 240 m).

2. Pseudophegopteris.

Ching, Acta Phytotax. Sinica. 8: 313. 1963; Holttum in Blumea 17: 12. 1969; et in 19: 26. 1971.

Stipes and rachis usually castaneous and glossy, scaly at base, thin, red-brown, marginal hairs absent; scales on frond in most cases sparse, appressed, sometimes reduced to a single row of short cells with dark to red brown walls. Fronds usually large, bipinnate to bipinnatifid with adnate pinnules. Lower pinnae in most cases reduced; veins free, usually forked, not running to margin; hairs on lamina acicular or short-capitate. Sori exindusiate, often spread

a little long veins; sporangia sometimes bearing acicular hairs; spores pale, with a slightly raised surface reticulum.

Species about 20; 2 in Nagaland.

K E Y T O S P E C I E S

Rachis dark-purplish, glabrous; both surfaces of lamina glabrous . . . . . aurita

Rachis purplish-brown, hairy; lamina short hairy . . . . . pyrrhorhachis

Pseudophegopteris aurita (Hook.) Ching in Acta Phytotax. Sinica 8: 313. 1963; Baishya & Rao, Ferns & Fern-allies Meghalaya 86. 1982.

Gymnogramme aurita Hook., Icon. Pl. t. 974. 1854; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 568. 1880.

Grammitis aurita Moore in Gard. Chron. f. 389C. 1856; Bedd., Ferns Brit. India t. 152. 1865.

Leptogramme aurita Bedd., Handb. Ferns Brit. India 377. 1883.

Thelypteris aurita (Hook.) Ching in Bull. Fan. Mem. Inst. Biol. Bot. 6: 266. 1936; Nohara & Bir, Pterid. Fl. Darjeeling & Sikkim Himalayas 152. 1964; Iwatsuki in Fl. East. Himal. (3 Rep.). 192. 1975.

Rhizome up to 0.5 cm wide, wide-creeping, dark, sparsely covered with pale brown, ovate to linear-lanceolate, hair-pointed scales; scales up to 0.4 x 0.1 cm. Stipes up to 30 cm or more long, slender, dark-purplish, shining, glabrous; lamina up to 60 x 30 cm or more, pinnate to pinnatifid; lateral pinnae numerous, usually 12 pairs or more, distant, usually opposite or subopposite, sessile, the lowest pair somewhat reduced; largest pinnae up to 18 x 7 cm, usually elliptic, deltoid to subcordate at base, gradually tapering into a lanceolate acuminate apex, margin deeply cut down very near or quite to costae into pinnules or lobes, the lowest basal pair of pinnule largest, about 4.5 x 1 cm, usually falcate, lanceolate-acuminate, margin bluntly crenate, the rest above rather shorter, entire or crenate; texture subcoriaceous; rachis dark-purplish to pale-brown, glabrous, shining, both surfaces of lamina usually glabrous, veins free, forked. Sori short-oblong, brown, dorsal on veins, naked.

Frequent in moist, shady humus covered forest floors.

Fertile: August - September.

Distribution: BHUTAN, INDIA - Assam, Meghalaya up to 100 - 1900 m; Sikkim, Himalayas.

Specimens examined: Jamir 7087 Kohima (Kohima dist., 1500 m); 7301 Changki village (Mokokchung dist., 1600 m).

Pseudophegopteris pyrrhorhachis (Kze) Ching Acta Phytotax. Sinica 8: 315. 1953; Holttum in Blumea 17: 24. 1969.

Polypodium pyrrhorachis Kze. Linnaea, 24: 257. 1851.

Thelypteris brunnea (C. Chr.) Ching in Bull. Fan. Mem. Inst. Biol. 6: 269. 1936; Holttum, Fl. Malaya 2: 240. 1968; Dhir, Ferns. N.W. Himalayas 98. 1980.

Dryopteris brunnea C. Chr., Ind. Fil. 255. 1906.

Polypodium distans D. Don Prodr. Fl. Nepal 2. 1825.

Aspidium palludosum Bedd., Ferns South India t. 168. 1863 (non Radd. 1825).

Rhizome creeping. Stipes up to 45 cm or more long, purplish brown, clothed with short-hairs or glabrous, glossy; lamina up to 60 x 25 cm, bipinnate with adnate pinnules; lateral pinnae numerous, up to 15 pairs or more, alternate to subopposite, the lowest 1 - 3 pairs slightly reduced and more distant; largest lateral pinnae up to 15 x 3.5 cm, sessile, gradually narrowed, acuminate, margin deeply cut down nearly to the costa into lobes, up to 0.6 cm wide at base, nearly at right angles to costa, obtuse or rounded at apex, margin more or less deeply crenate or toothed; texture thin but firm; rachises purplish-brown, covered with short, pale hairs; costae and costules dark-brown, more or less densely clothed with short hairs; hairs on lamina acicular or short capitate, never conspicuously

gland-like; veins free, usually forked, not running to margin. Sori medial, brown, exindusiate; sporangia shortly stalked, brownish, sometimes bearing acicular hairs; spores pale-brown.

Frequent, prefers to grow on open sunny slopes of mountains, specially along streams and water courses.

Fertile: October.

Distribution: AFRICA, ASIA, MALAYA, POLYNESIA, HAWAII, AND INDIA - Himalayan region.

Specimens examined: Jamir 6344 Shamator (Tuensang dist., 1690 m).

3. Metathelypteris

(H.Ito) Ching, Acta Phytotax. Sinica 8: 305. 1963; Holttum in Blumea 19: 26 - 27. 1971.

Stems short, suberect. Fronds approximate. Lamina simple pinnate to bipinnatifid, pinnae deeply lobed; veins in pinnae lobes free, often forked, always ending before the margin; costae prominent, not grooved on upper surface; lower surface clothed with acicular or short capitate hairs, often spherical, sessile glands present. Sori thinly indusiate; sporangia sometimes with a hair on stalk,

glands absent near annulus; spores dark, opaque; exine with thick wings or raised banks.

A genus of about 12 species; 1 in Nagaland.

Metathelypteris gracilescens (Blume) Ching in Acta Phytotax. Sinica 8: 305. 1963; Chen-meng Kuo, Fl. Taiwan 2: 419. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 84. 1982.

Aspidium gracilescens Blume, Enum. Pl. Jav. 155. 1828.

Lastrea gracilescens Moore, Ind. Fil. 93. 1858; Bedd., Handb. Ferns Brit. India 234. 1883.

Thelypteris gracilescens Ching in Bull. Fan. Mem. Inst. Biol. 6: 327. 1936.

Rhizome short-creeping; roots rather wiry. Stipes 15 - 25 cm long, tufted, pale to slightly reddish when dry, scaly at base; scales narrowed, linear, up to 0.2 cm long. Lamina 20 - 30 x 5 - 12 cm, bipinnate, lanceolate; pinnae numerous, 15 - 22 pairs, subopposite or alternate, sessile, rather falcate, basal pinnae somewhat narrowed; largest pinnae up to 7 x 1.5 cm, delto-lanceolate, deeply lobed almost to costae, apex acute; lobes up to 1 x 0.3 cm; entire or slightly crenate; lower surface of rachis and costae with a few acicular hairs, mostly on distal parts, while upper surface densely hairy (sparsely in costules),

veins 5 - 7 pairs, simple or often once forked. Sori rather small, medial, indusiate; indusia thin, glabrous or often with short hairs.

Fairly common on humus soil in shady slopes of hills.

Fertile: July - October.

Distribution: JAPAN, TAIWAN, PHILIPPINES, MALAYA, POLYNESIA, INDIA - N. E. India.

Specimens examined: Jamir 6645 Mon (Mon dist., 898 m); 6124 Kohima (Kohima dist., 1445 m).

4. Macrothelypteris

(H.Ito) Ching, Acta Phytotax. Sinica 8: 308. 1963; Holttum in Blumea 19: 27. 1971.

Rhizome short. Stipes scaly at base; scales thickened at bases with acicular or capitate, marginal and superficial hairs. Fronds bipinnate to tripinnatifid, pinnules adnate; rachis sometimes clothed with scales with thickened bases, often marginal hairy, always acicular hair-tipped, septate hairs long, slender; veins usually forked, not reaching margin. Sori small, indusiate; sporangia bearing capitate hairs near annulus; spores winged.

A genus of about 10 species; 1 in Nagaland.

Macrothelypteris torresiana (Gaud.) Ching, Acta Phytotax. Sinica 8: 310. 1963; Holttum, Blumea 17: 27. 1969; et in Gard. Bull. 29: 148. 1976; Chen-meng Kuo, Fl. Taiwan 1: 417. (ed. 2). 1980.

Polystichum torressianum Gaud. in Frey. Voy. Bot. 333. 1824.

Thelypteris torresiana (Gaud.) Alston, Lilloa 30: 111. 1960.

Thelypteris uliginosa (Kunze) Ching, Bull. Fan. Mem. Inst. Bot. Linnaea 6: 342. 1936; Holttum, Fl. Malaya 2: 241. 1968.

Aspidium uliginosum Kunze Linnaea 20: 6. 1847.

Rhizome short-creeping to suberect, stout; fronds tufted. Stipes 50 - 60 cm long, rather stout, pale to yellowish-brown, scaly at base; scales up to 1 cm long, linear-lanceolate, brown, shining and sparsely acicular hairy on the margins as well as surfaces; lamina up to 65 x 25 cm or more, ovate-lanceolate in outline, tripinnatifid; pinnae up to 15 pairs, sessile or shortly stalked, subopposite or alternate, the lowest pair somewhat reduced; largest pinnae up to 30 x 9 cm, delto-lanceolate; pinnules numerous, alternate, sessile to adnate; largest pinnae up to 6.5 x 1.5 cm, oblanceolate-acuminate, deeply cut down almost to costa into segments; segment up to 1 x 0.2 cm

or slightly more, oblong, obtuse, sharply crenate or toothed, texture herbaceous; rachis glabrous, pale yellowish-brown, smooth; costae and costules clothed with multicellular hairs beneath; lower surface bearing short, erect unicellular, capitate hairs; veins up to 7 pairs, forked. Sori round, indusiate; indusium inconspicuous, fugaceous; sporangia shortly stalked, with 2 - 4 capitate hairs; spores round; exine spinulose.

Common and at certain places very abundant; rather in forest cleared areas and along roadsides on hills.

Fertile: July - February.

Distribution: ASIA, JAPAN, MALAYA, AUSTRALIA, POLYNESIA, HAWAII, TAIWAN, NORTH AMERICA, INDIA - N.E. India.

Specimens examined: Jamir 7065. 7107, 6192 Changki (Mokokchung dist., 1000 m); 6324 Morong forests, Sangpor (Tuensang dist., 2136 m); 6559, 6563 Chumuketema (Kohima dist., 250 m); 6624, 6629 Mon (Mon dist., 898 m); 7144 Kohima (Kohima dist., 1445 m); 7164 Dimapur (Kohima dist., 100 m).

5. Cyclosorus

Link., Hort. Berol. 2: 128. 1833; Holttum in Blumea 19: 27 - 28. 1971; Copel., Gen. Fil. 140. 1947.

Rhizome long creeping; fronds bipinnatifid, distant, basal pinnae not reduced; lower surface of costae clothed with thin, flat scales; spherical, glandular cells present on lower surface of veins; hairy on the stalk of sporangia Sori indusiate; spores irregularly spinulose, perine absent.

A genus of about 4 species; 1 in Nagaland.

Cyclosorus gongylodes (Schkur) Link., Berol. 2: 128.1833; Holttum, Fl. Malaya 2: 261. 1968; et in Blumea 18 (1): 200. 1970.

Aspidium gongylodes Schkur, Kryp. Gew. 1: 193, t. 33C. 1809.

Nephrodium unitum quoad Bedd., Handb. Ferns Brit. India 268. 1883.

(Plate 88)

Rhizome up to 0.6 cm in diam., slender, wide-creeping, apex clothed with more or less narrow, light-brown scales. Fronds 1 - 1.5 cm, distant; roots black, wide-spreading. Stipes 25 - 50 cm long, scaly at base when young, basal part glabrous and pale-brown. Lamina up to 45 x 18 cm,

simple pinnate; lateral pinnae 15 - 22 pairs, or more, usually oblique or spreading, alternate or subopposite, sessile or shortly petiolate, with a terminal pinna similar to lateral ones except for its broader base; the lowest pair somewhat shortened; largest pinnae up to 12 x 1 cm, shortly petiolate, truncate to cuneate at base, shortly acuminate, margin cut down about 1/3 into lobes; lobes up to 0.3 cm wide at base, slightly oblique, rounded, margins entire, shortly acuminate at apex; glabrous above, rachis glabrous or sparsely hairy beneath; lower surface of costae with or without spreading, short hairs, clothed with small broadly ovate, thin, brown deciduous scales; costules and veins glabrous beneath or more or less densely clothed with hairs like the costae, and usually with round orange glands; texture subcoriaceous; veins 8 - 10 pairs, the lowest spreading and anastomosing with corresponding veins of adjacent groups fomring a long excurrent vein running to the sinus between the lobes, the next acroscopic vein of a costule often joining the same excurrent vein, the corresponding second basiscopic vein usually joining the short, hyaline membrane at the sinus, the remaining ones running up to the margin; all veins oblique except the lowest basal pair. Sori medial, in a close, continuous row; indusia reniform, with profuse, unicellular, pointed and glandular hairs; sporangia short stalked; annulus of 10 - 18 cells, vertical; multicellular glandular

paraphyses occur between the sporangia; spores bilateral, monolete; exine densely spinulose and baculate.

Fairly common in open, swampy places in lowlands; sometimes forming large populations in vast areas.

Fertile: December.

Distribution: TAIWAN, MALAYA, INDIA - Throughout lowlands.

Specimens examined: Jamir 7939 Dimapur near power house project (Kohima dist., 200 m).

6. Thelypteris

Schmidel, Icon. Pl. ed. Keller 3, 45. t. 11. 13. 1763 (nom. cons.); Fernald & Weatherby Rhodora 21: 21 - 36. 1919; Pichi-Sermolli, Webbia 9: 409-417. 1954; Holttum in Taxon 17: 330. 1968; et in Blumea 19: 28. 1971.

Rhizome slender, long-creeping; fronds simple pinnate; pinnae deeply lobed; basal pinnae not reduced; veins all free, often forked, all running to margin; lower surface of costae with small, flat, thin scales; lamina with acicular and short capitate hairs. Sori indusiate; short capitate, glandular hairs present on sporangia near annulus; spores with spinulose exine.

A large genus represented in Nagaland by 5 species.

K E Y T O S P E C I E S

1a. Pinnae 4 - 8 cm long.

2a. Lamina glabrous above except costae . . . . . falciloba

2b. Lamina strigose hairy above . . . . repens

1b. Pinnae more than 8 cm long.

3a. Pinna rachis glabrous and much raised on the lower surface. . . . xylodes

3b. Pinna rachis hairy.

4a. Pinnae lobes 3 - 5 mm wide . . erubescens

4b. Pinnae lobes 1 - 3 mm wide . . octhoides

Thelypteris erubescens (Wall. ex Hook.) Ching, Bull. Fan. Mem. Inst. Biol. 6: 293. 1936; Iwatsuki in Fl. East. Himal. (3 Rep.) 192. 1975; Dhir, Ferns N.W. Himalayas 99. 1980.

Polypodium erubescens Wall. ex Hook., Sp. Fil. 4: 236. 1862.

Phegopteris erubescens Bedd., Handb. Ferns Brit. India 289. 1883.

Dryopteris erubescens C. Chr., Ind. Fil. 263. 1905.

Rhizome short, erect, stout. Stipes up to 75 cm long, tufted, stout, pale-brown, glabrous or sparsely hairy.

Lamina up to 90 x 40 cm or more, broadly ovate, acuminate, pinnate; pinnae numerous, about 20 - 30 pairs, subopposite or alternate, sessile; lower few pairs reduced; largest pinnae up to 25 x 2 cm or more, oblong-elongate, truncate at base, gradually acuminate, margin deeply cut down almost nearly to costa; lobes up to 0.5 cm wide at base, oblong, subfalcate, rather acute or rounded, entire, texture firm, subcoriaceous, main rachis grooved on upper side when dry, both surfaces of rachis and costae more or less densely covered with whitish hairs, sparsely hairy on the veins ; veins 7 - 11 pairs, simple, free, the two lowermost opposite pairs usually uniting at the sinus. Sori small, in 2 rows, one on each side of costule, medial, indusiate; indusia rather large, reniform, thin, transparent, membranous.

Rare; in moist shady hill slopes.

Fertile: October - February.

Distribution: MALAYA, BHUTAN, INDIA - Himalayas, Kashmir, Meghalaya at 900 - 2000 m elevation.

Specimens examined: Jamir 7992 Changki Achep, (Mokokchung dist., 1000 m); 6503 Wokha (Wokha dist., 1313 m).

Thelypteris falciloba (Hook.) Ching, Bull. Fan. Mem. Inst. Biol. 6: 298. 1936; Iwatsuki in Fl. East. Himal. (3 Rep.) 192. 1975.

Nephrodium falcilobum Hook., Sp. Fil. 108. 1862; Clarke Ferns North India 515. 1880.

Lastrea falciloba Bedd., Ferns South India, 37, t. 105. 1863.

Rhizome short-creeping, stout; fronds tufted; roots wiry, long spreading. Stipes up to 30 cm or more long, tufted, rather stout, shortly hairy. Lamina 15 - 45 x 6 - 12 cm, ovate-lanceolate, pinnate, acuminate; pinnae 10 - 18 pairs, opposite or alternate, sessile, the lowest pair slightly shortened or not, largest pinnae up to 8 x 1.5 cm, linear-lanceolate, subtruncate or unequal at base, gradually narrowed to a lanceolate acuminate apex, margin deeply cut down almost nearly reaching to the costa into lobes; lobes up to 0.3 cm wide at base, oblong, rather falcate, obtuse at apex; the lowest basal lobe of each pinna usually much longer than the others; texture subcoriaceous; rachis clothed with short hairs throughout, more or less hairy on both surfaces of lamina; veins simple, sometimes once forked, the lowest anterior vein runs to the sinus. Sori rather large, often occupying almost all the surfaces of pinnae, indusiate; indusium reniform, hairy.

Fairly common , along banks of streams and rivers; sometimes grows on rocks in river beds.

Fertile: February.

Distribution: BURMA, CHINA, INDIA - Nilgiris, Sikkim, North India, Meghalaya and Assam.

Specimens examined: Jamir 7081, 7039 Changki, Achen (Mokokchung dist., 240 m).

Thelypteris ochthoides (Kuntze) Ching, Bull. Fan. Mem. Inst. Biol. Bot. 6: 300. 1936.

Aspidium ochthoides Kuntze, Ferns South India t. 106. 1863.

Lastrea ochthoides (Kuntze) Bedd., Handb. Ferns Brit. India 240. 1883.

Rhizome short, erect. Stipes up to 65 cm long, rather stout, glabrous or sparsely hairy. Lamina up to 70 x 25 cm, or more, pinnate; pinnae numerous, 20 - 30 pairs, basal shorter, subopposite or alternate, sessile with a prominent gland at the base beneath; the lower about 18 pairs gradually long attenuate or shortened towards base; largest pinnae 20 x 2.5 cm, lanceolate acuminate, truncate or subtruncate at base, margin cut down 2/3 or almost quite to the costae into lobes; lobes up to 0.4 cm wide at base, entire, round to obtuse, sometimes falcate, the lowest

basal pair of lobes usually longer than the rest; texture subcoriaceous; rachis, costae and costules more or less densely clothed with short hairs on both surfaces; margin sparsely hairy; veins simple, prominent, 10 - 15 pairs. Sori medial, indusia small, hairy when young.

Fairly common in moist, rather shady forested hill slopes.

Fertile: October.

Distribution: MALAYA, SRILANKA, INDIA- throughout South India on hills; North India - throughout Himalayas, Meghalaya.

Specimens examined: Jamir 6655 Mon (Mon dist., 898 m).

Thelypteris repens (Hope) Ching, in Bull. Fan. Mem. Inst. Biol. 6: 304. 1936; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim Himalayas 149. 1964; Iwatsuki in Fl. East. Himal. (3 Rep.) 193. 1975; Dhir, Ferns N.W. Himalayas 97. 1980.

Pseudocyclosorus repens (Hope) Ching, Acta Phytotax. Sinica 8:. 324. 1963.

Nephrodium repens Hope in J. Bomb. nat. Hist. Soc. 12: 535. t. 8. 1899.

Rhizome erect to semierect, slender to nearly stout. Stipes up to 55 cm or more long, tufted, pale-brown, glabrous or sparsely hairy throughout; lamina up to 30 - 60 x 12 - 25 cm or more, obovate-lanceolate in outline, pinnate; pinnae numerous, 20 - 28 pairs, opposite to alternate, sessile, prominently glandular at the base beneath; the lower up to 12 pairs of pinnae suddenly shortened towards base; largest pinnae up to 15 x 2.5 cm or more, truncate to subtruncate at base, gradually tapering into lanceolate acuminate apex, margin cut down 2/3 way almost towards costae into lobes or segments; lobes up to 0.2 - 0.4 cm at base, slightly oblique, obtuse, entire, the lowest basal pair of lobes nearest to rachis somewhat elongated than the rest above; texture thin but firm; rachises clothed with pale, thin scales or hairy throughout; costae and costules rather densely hairy on both surfaces; lamina with similar hairs on both surfaces but more sparsely; veins simple, prominent, about 8 - 14 pairs on each lobe. Sori medial, arranged in two rows one on either side of costule; indusia up to 0.1 cm wide, reniform, pale brown, short-hairy; sporangia stalked, brown.

Abundant, pereders damp, shady calcareous soils near ravines and streamlets.

Fertile: May - October.

Distribution: Throughout the Himalayan region.

Specimens examined: Jamir 6104 Kohima (Kohima dist., 1445 m); 7166 Dimapur (Kohima dist., 200 m); 6623 Mon (Mon dist., 898 m); 6394 Mezenkong (Mokokchung dist., 1326 m); 6063 Peren/Embai forests (Kohima dist., 1446 m); 6314 Shamator village (Tuensang dist., 1690 m).

Thelypteris xylodes (Kuntze) Ching, Bull. Fan. Mem. Inst. Biol. 6: 296. 1936; Mehra & Bir, Res. Bull. Punjab. Univ. (N.S.) 15: 150. 1964; Iwatsuki in Fl. East. Himal. (3 Rep.) 193. 1975; Dhir, Ferns N.W. Himalayas 97. 1980.

Aspidium xylodes Kuntze, in Linnaea 24: 283. 1851.

Lastrea ochthodes var. xylodes Bedd., Ferns South India t. 107. 1863; et Handb. Ferns Brit. India 240. 1883.

Nephrodium prolixum Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 516. 1880.

Rhizome erect to semierect, stout, Stipes up to 60 cm or more long, rather stout, brown, stramineous and curved at base, glabrous above. Lamina up to 70 x 30 cm or more, broad obovate-lanceolate in outline, pinnate; pinnae 20 - 30 pairs, alternate or subopposite, sessile with a prominent gland at the base beneath; lower pinnae abruptly reduced to tuberculate gland, largest pinnae up to 25 x 2.5 cm,

linear-oblanceolate, truncate or subtruncate at base, rather long acuminate, margin deeply cut down almost to costae into lobes; lobes up to 1.5 x 0.4 cm, oblong, rather falcate, obtuse or shortly acuminate, entire, texture firm, rather coriaceous; rachis, costae and costules glabrous beneath; 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; indusia reniform, pale-brown, entire; sporangia shortly stalked.

Very rare; in most shady places in forested areas.

Fertile: July - Septebmer.

Distribution: SRILANKA, INDIA - South India, Nilgiri hills, North Western Himalayas.

Specimens examined: Jamir 6171 Changki (Mokokchung dist., 1000 m); 6087, 8081 Kohima (Kohima dist., 1445 m).

7. Cyclogramma

Tagawa, Acta Phytotax. Geobot. 7: 52. 1938; Copel., Gen. Fil. 136. 1947; Ching Acta Phytotax. Sinica 8: 316. 1963; Holttum, Blumea 19: 28. 1971.

Rhizome short to long creeping. Stipe scales with acicular or hooked hairs; fronds also with short hooked

hairs on lower surface; lower pinnae reduced or not; areophores at bases of pinnae at least swollen, in most species elongate; pinnae deeply lobed; veins spreading, basal ones from adjacent costules running to edge close to or just above sinus membrane, never uniting. Sori exindusiate, along veins, no glandular hairs on stalks of sporangium; spores pale with a translucent wing or finely spinulose.

Species about 7; 1 in Nagaland.

Cyclogramma auriculata (J.Smith) Ching, Acta Phytotax. Geobot. 19: 11. 1961; Chen-meng Kuo, Fl. Taiwan 1: 408. t. 138. 1980.

Phegopteris auriculata J.Smith, Hist. Fil. 233. 1875; Bedd., Handb. Ferns Brit. India 290. t. 149. 1883.

Thelypteris auriculata (J. Smith) K. Iwatsuki, Acta Phytotax. Geobot. 19: 11. 1961; Iwatsuki in Fl. East Himal. (3 Rep.) 191. 1975.

(Plate 89)

Rhizome short-creeping, erect or suberect. Stipes 10 - 15 cm long, tufted, stout, densely hairy, rather densely scaly at base and sparsely above; scales black to dark-brown, ovate-lanceolate, about 1 x 0.3 cm. Lamina up to 75 x 30 cm or more, oblanceolate-acuminate, pinnatifid, large; pinnae numerous, subopposite or alternate, sessile,

the lower 5 - 6 pairs of pinnae shortened into auricles, largest pinnae up to 23 x 3 cm, ovate-lanceolate, acuminate, margin deeply cut down almost nearly to the rachis; segments up to 0.8 cm wide at base, oblong, rounded or obtuse at apex, entire, subfalcate, base of pinnae with hook-like glands on the lower surface, rachis costae, and costules and veins clothed with hairs, sparsely hairy on both surfaces of lamina; texture, thin, membranous; veins 11 pairs, simple, pinnate, runs up to the margins, lowest pair entering slightly above the sinus. Sori small, round, in a single row on either side of costae, exindusiate, sporangia short-stalked, usually with 1 - 2 hooked hairs.

Rare; in moist, shady places near streams and river banks in dense forests.

Fertile: October.

Distribution: CHINA, JAVA, BHUTAN, TAIWAN, FORMOSA, INDIA - Himalayas, Sikkim, Darjeeling, Meghalaya at 1800 - 2800 m elevation.

Specimens examined: Jamir 6377, 6322 Morong forests, Sangpore (Tuensang dist., 2136 m).

8. Trigonospora

Holttum in Blumea 19: 29. 1971.

Rhizome erect to semierect. Fronds tripinnatifid; pinnae not reduced at base; areophores at the base of pinnae not swollen; veins free, or rarely anastomosing, simple veins in acroscopic basal lobe of pinnae terminating into the sinus membrane, while on basioscopic lobe reach before the sinus membrane. Sori medial, indusiate; sporangial stalks multicellular hairy; spores trilete, minutely papillate.

A genus comprising of 8 species;1 in Nagaland.

Trigonospora ciliata (Benth.) Holttum in Blumea 19(1): 29. 1971; Baishya & Rao, Ferns & Fern-allies Meghalaya 87. 1982.

Aspidium ciliatum Wall. ex Benth., Fl. Hongk. 455. 1861 (descr.).

Lastrea ciliata Hook. in J. Bot. Kew Misc. 9: 338. 1857.

Nephrodium ciliatum Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 514. 1880.

Lastrea calcarata var. servicea Bedd., Handb. Ferns Brit. India 237. 1883.

Dryopteris pseudocalcarata C. Chr., Ind. Fil. Suppl. 3: 95. 1933.

Thelypteris ciliata (Wall. ex Benth.) Ching, in Bull. Fan. Mem. Inst. Biol. Bot. 6: 289. 1936; Holttum, Fl. Malaya 2: 250. 1954.

Rhizome short, erect; fronds tufted; roots dense, black. Stipes up to 40 cm long, more or less densely clothed with soft, pale hairs; young circinate frond covered with small, broad, dark, early deciduous scales. Lamina up to 40 x 20 cm, unipinnate; pinnae 16 - 18 pairs, alternate, sessile, usually oblique, the lowest pinnae usually deflexed but not shortened; the acuminate apical lamina deeply lobed; largest pinnae up to 10 x 2 cm, oblanceolate, base unequal, broadly cuneate to truncate on acroscopic side, rounded on the basioscopic side, caudate-acuminate, margin cut down 1/2 way towards costae into lobes; the lowest lobe elongated into an auricle; lobes up to 0.5 cm wide at base, subfalcate, slightly oblique, entire, round or blunt, texture herbaceous, both surfaces of costae clothed with hairs; costules scattered hairy on lower surface; veins up to 4 - 7 pairs, simple, the lowest anterior vein of a group running to the surface of fertile pinnae, indusiate; indusium large, persistent, hairy.

Abundant; firmly attached on rocks near streamlets and in rivers. This species can withstand submergence during floods in rainy season.

Fertile: February.

Distribution: MALAYA, SRI LANKA, BURMA, CHINA, SUMATRA, INDIA - South India, Himalayas, Meghalaya.

Specimens examined: Jamir 7988, 7042, 7887 Changki (Mokokchung dist., 1000 m).

9. Parathelypteris

Holttum in Blumea 19: 32. 1971.

Rhizome creeping, slender, often elongate, scales with superficial unicellular hairs; hairs either spherical, acicular or capitate; basal pinnae slightly reduced; pinnae deeply lobed, few; basal acroscopic lobe or leaflet often somewhat enlarged, toothed; veins free, acicular hairs on lower surface of costae present, often septate, upper surface always with unicellular hairs; scales reduced on lower surface of costa; sessile glands almost always present on lower surface. Sori indusiate; sporangia short-stalked, glands or setae absent at annulus; spores hyaline, often opaque, exine with narrow wings.

About 40 species; 1 in Nagaland.

Parathelypteris glanduligera (Kuntze) Ching in Acta Phytotax. Sinica 8: 303. 1963; Chen-meng Kuo, Fl. Taiwan 1: 424. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 84. 1982.

Aspidium glanduligerum Kuntze, Analect. Pterid. 44. 1837.

Lastrea gracilescens sensu Bedd., Handb. Ferns Brit. India 234. 1883.

L. gracilescens var. glanduligera Bedd., Handb. Ferns Brit. India Suppl. 51. 1892.

Thelypteris glanduligera Ching in Bull. Fan. Mem. Inst. Biol. 6: 320. 1936.

Rhizome wide-creeping, wiry. Stipes 15 - 30 cm long, slender, pale, stramineous, approximate; scales narrow with capitate hairs on surface. Lamina 15 - 35 x 6 - 12 cm, delto-lanceolate, bipinnate; pinnae rather numerous, 15 - 22 pairs, subopposite or alternate, well spaced, sessile; the lowest pair of pinnae rather longest or nearly so; largest pinnae up to 8 x 2 cm, deeply cut down almost to costa into lobes; basal acroscopic lobe sometimes enlarged and dentate, rest entire, obtuse at apex; veins 4 - 8 pairs, simple, free; acicular hairs on lower surface of rachis and costae present, glands scattered between the veins; upper surface of rachis and costae clothed with copious acicular hairs. Sori rather small, submarginal, near

apices of veins, indusiate; indusium with short hairs and glands.

Fairly common in moist and shady forest floors; also along roadsides on hills.

Fertile: May - October.

Distribution: JAPAN, KOREA, TAIWAN, CHINA, VIETNAM, INDIA - Assam, Meghalaya.

Specimens examined: Jamir 7109 Changki (Mokokchung dist., 1000 m); 6635 Mon (Mon dist., 898 m).

10. Coryphopteris

Holttum in Blumea 19(1): 33. 1971. = Parathelypteris sect. Melanostipes Ching, Acta Phytotax. Sinica 8: 301.1963.

Terrestrials. Rhizome erect, bearing roots throughout. Stipes dark throughout or paler distally, broad scaly at base; scales sometimes bearing spreading, septate hairs near the base or hairy throughout. Lamina usually pinnate, apex never pinnae-like; lowest pinnae not or somewhat reduced, narrowed towards thin bases and often broader at middle, basal acroscopic lobe often enlarged, dentate with some forked veins, sometimes free; aerophores at bases of pinnae somewhat swollen; pinnae always deeply lobed, one or more basal lobes somewhat free; veins simple or rarely once forked;

lower surface of rachis, costae, costules and veins always bearing small filiform scales; spreading acicular hairs usually present on lower surface of axes of frond, often short capitate hairs of longer septate hairs; lower surface clothed with sessile glands; upper surface of rachis always clothed with acicular, unicellular hairs, often septate; sessile or capitate or acicular hairs sometimes present on upper surface between veins; costa always grooved on upper surface. Sori large, indusiate; indusia glandular or hairy; sporangia short-stalked, glands or hairs absent near annulus, sometimes with a sessile gland on the stalk; spores pale translucent; exine with continuous wing and a few cross-wings.

Species about 30; 2 in Nagaland.

K E Y T O S P E C I E S

Stipe clothed with pale, multiseptate hairs; pinnae not lobed up to costae. . hirsutipes

Base of stipe not clothed with such hairs; pinnae lobed almost to costae . . viscosa

Coryphopteris hirsutipes (Clarke) Holttum in Nayar et Kaur, Companion to Bedd., Handb. 203. 1974; Baishya & Rao, Ferns & Fern-alies Meghalaya 83. 1982.

Nephrodium gracilescens var. hirsutipes Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 514. t. 67, f.1. 1880.

Lastrea gracilescens sensu Bedd., Handb. Ferns Brit. India 234. 1883 (pro parte).

L. hirsutipes Bedd., Handb. Ferns Brit. India Suppl.

Thelypteris herbacea Holttum in Gard. Bull. Singapore 11: 268. 1947; et Fl. Malaya 2: 254. t. 145. 1954.

Rhizome short, erect, stout, fronds tufted. Stipes 15-30 cm long, hirsute throughout, scaly at base; scales linear ovate-lanceolate, brown. Lamina 20 - 35 x 10 - 15 cm, lanceolate, unipinnate; pinnae numerous, up to 20 pairs, alternate, sessile, basal 2 - 5 pairs somewhat shortened, largest pinnae up to 10 x 2.2 cm, subtruncate at base, gradually acuminate at apex, margin cut down 1/2 way towards costa into lobes; lobes up to 0.3 cm wide at base, oblong, round or blunt, texture subcoriaceous; lower surface of rachis and costae clothed with unicellular hairs, often glands; upper surface of rachis and costae clothed with septate hairs, unicellular hairy in between veins; veins 3 - 6 pairs, free, simple. Sori rather large, basal or medial on veins, indusiate; indusia large, hairy; hairs septate.

Fairly common on hill slopes, rather in exposed areas.

Fertile: May.

Distribution: INDIA - Meghalaya at 1200 - 1500 m elevation.

Specimens examined: Jamir 7182 Tezu river (Phek dist., 1200 m).

Coryphopteris viscosa (Baker) Holttum in Blumea 19: 33. 1971; Baishya & Rao, Ferns & Fern-allies Meghalaya 83. 1982.

Nephrodium viscosum Baker, Syn. Fil. 264. 1867.

Lastrea viscosa Bedd., Ferns Brit. India t. 334. 1870; et Handb. Ferns Brit. India 238. 1883.

Thelypteris viscosa Ching, in Bull. Fan. Mem. Inst. Biol. 10: 215. 1941; Holttum, Fl. Malaya 2: 252.1968.

Rhizome short, erect. Stipes 15 - 30 cm long, rather stout, dark-brown at base and pale above; basal scales thin, linear-lanceolate; lamina 25 - 50 x 12 - 20 cm, unipinnate, oblanceolate in outline; pinnae 25 - 30 30 pairs, closely placed, broadest near the middle, 4 - 9 pairs of lower pinnae gradually reduced and deflexed; largest pinnae up to 14 x 2 cm, sessile, base truncate, with acroscopic lobe usually more elongate, gradually tapering into a lanceolate, acuminate apex; lobes up to 0.4 cm wide at base,

linear-oblong, margin entire, round or obtuse at apex; texture herbaceous, lower surface of rachis and costae clothed with copious, acicular hairs mixed with a few short capitate hairs and glands; scales on costae linear, 1 - 2 cells wide; upper surface of costae clothed with unicellular hairs, sparsely hairy on costules and veins, glands throughout upper surface; veins 5 - 6 pairs, simple, prominently raised on the lower surface. Sori medial, indusiate; indusia thin, reniform, brownish, rather firm with a few glands.

Rare; in shady slopes of jhums.

Fertile: October.

Distribution: PHILIPPINES, BORNEA, MALAYA, INDIA - Meghalaya at 1000 m elevation.

Specimens examined: Jamir 6641 Mon (Mon dist., 898 m).

11. Amphineuron

Holttum in Blumea 19(1): 45. 1971.

Rhizome short-creeping to suberect, scaly; scales narrow, setiferous. Stipes scaly at base, minutely hairy throughout. Lamina large, pinnate; pinnae deeply lobed; basal pinnae much narrowed at their bases. Areophores at bases of pinnae

elliptic, not swollen; veins simple pinnate in pinna-lobes, basal pair of veins free or runs to the margin or connivent at the sinus membrane, or anastomosing to an excurrent veinlet; lower surface of pinnae with short acicular hairs mixed with glandular hairs. Sori indusiate or exindusiate, confined to pinnae-lobes; indusia glandular, hairy; sporangia slender stalked; stalk hairy; spores dark, exine irregularly tuberculate or rugose.

A genus with about 15 species; 1 in Nagaland.

Amphineuron apulentum (Kaulf.) Holttum in Blumea 23(2): 212, 214. 1977; Baishya & Rao, Ferns & Fern-allies Meghalaya 79. 1982.

Aspidium apulentum Kaulf., Enum. Fil. Chamisso 238. 1824.

Nephrodium extensum Moore, Ind. Fil. 91. 1858; Bedd., Handb. Ferns Brit. India 269. 1883.

Cyclosorus extensus (Moore) Ching in Bull. Fan. Mem. Inst. Biol. Bot. 8: 182. 1938; Holttum, Fl. Malaya 2: 264. 1954.

Nephrodium punctatum Parish ex Bedd., Ferns Brit. India t. 131. 1866.

N. parasiticum var multijugum Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 533. 1880.

Rhizome short-creeping. Stipes 30 - 70 cm long, slightly rufescent, short-hairy in grooves, scaly at base, scales linear-lanceolate, brown. Lamina up to 80 x 30 cm, simple, pinnate; pinnae 20 - 27 pairs, usually with few pairs of basal pinnae alternate or subopposite, sessile; largest basal pair of pinnae much narrowed towards base, not auricled, apex of frond narrowly acuminate, deeply lobed and grading to upper pinna, largest pinna up to 20 x 2 cm, lobed about 3/4 towards costa, lobes up tp 0.4 cm wide at base, slightly oblique and falcate, obtuse or rounded; lower surface of rachis, costae and costules covered by short acicular hairs; veins, sinus-membrane, and margins clothed with small yellowish glandular hairs; upper surface of costae with pale acicular hairs, scattered on costules and veins, texture of lamina thin, subcoriaceous; veins 8 - 10 pairs on each lobe, basal pair touching sides of sinus-membrane or meeting below at varying angles to produce an excurrent veinlet. Sori mostly confined to lobes of pinnae, supra-medial, slightly sunk in depressions in lamina, indusiate; indusia thin, bearing marginal glandular hairs, often a few short acicular hairs on the surface; sporangia slender stalked, bearing short hairs with glandular tips on the stalks.

Very common on hill slopes along roadsides; sometimes near ditches, both in shady as well as in exposed places.

Fertile: July - February.

Distribution: SRILANKA, BURMA, CHINA, MALAYA, PHILIPPINES, THAILAND, CENTRAL AMERICA, WEST INDIES, EAST AFRICA, INDIA - South India, North Eastern India.

Specimens examined: Jamir 6050 Peren (Kohima dist., 1445 m); 7029 Changki (Mokokchung dist., 1326 m); 6411 Mon (Mon dist., 898 m).

12. Pronephrium

Presl, Epim. Bot. 258. 1849; Copel., Gen. Fil. 140. 1947.

Terrestrials. Rhizome suberect to wide-creeping, sparsely scaly. Fronds distant to proximate on rhizome, simple pinnate with free, apical pinnae, rarely simple; basal pinnae not or little reduced, often with narrow bases; apical lamina pinna-like or widened towards its base; pinnae crenate to entire, rarely conspicuously lobed; veins several pairs, usually anastomosing, thin united excurrent veins sometimes free, usually forming zig-zag composite veins alternating with costules; sinus-membrane short or absent; surfaces covered with acicular and capitate hairs, or sometimes with sessile glands; hairs hooked or curved. Sori exindusiate or indusiate, often hairy or with glands; sporangia often with acicular hairs near annulus, very rarely bearing both hairs and glands; spores with a conti-

nuous translucent wing and a few cross-wings.

A genus of about 70 species; 5 in Nagaland.

K E Y T O S P E C I E S

1a. Lamina simple pinnate.
  2a. Sori indusiate.
    3a. Rhizome short, erect or suberect; stipe slender; lateral pinnae more than 13 pairs . . . . . glandulosum
    3b. Rhizome long, wide-creeping; stipes stout; lateral pinnae up to 13 pairs . . . . . nudatum
  2b. Sori exindusiate; pinnae entire or wavy.
    4a. Stipe minutely hairy; pinnae 9 - 13, less than 8 cm long . . . . triphyllum var. parishi
    4b. Stipe glabrous or so; pinnae more than 13, often much larger . . . . lakhimpurense
1b. Lamina trifoliate . . . . . triphyllum

Pronephrium glandulosum (Blume) Holttum in Blumea 20 (1): 118. 1972.

Aspidium glandulosum Blume, Enum. Pl. Jav. 144.1828.

Rhizome short, erect to suberect. Stipes up to 40 cm or more long, slender, covered with thin, brown, soft, linear to ovate-lanceolate scales; scales about 0.7 cm long,

lamina up to 60 x 30 cm or more, pinnate; pinnae numerous, about 15 - 20 pairs, 2 - 3.5 cm apart, sessile, alternate, all spreading, except the lowest pair somewhat deflexed; lowest pinnae rather narrowed to the base, largest pinnae up to 20 x 2 cm, truncate at base and somewhat auricled above or below, gradually tapering into lanceolate, acuminate apex, margin cut down 1/3 - 1/4 way to costa into subtruncate lobes; lobes up to 0.4 cm wide at base, margin slightly toothed, texture thin but firm, rachises sparsely covered with scales similar to stipe ones; costae and costules covered with short, pale hairs or glabrous or sometimes covered with closely appressed hairs, lower surface closely clothed with round, yellowish glands; veins 5 - 8 pairs on each lobe, the lowest two pairs anastomosing forming an excurrent vein which meets the base of the hyaline sinus membrane (sometimes joined also by the next veins on the basioscopic side), the next two pairs, usually meeting the sides of the membrane. Sori brown. round, medial, in two rows, one on either side of the costules; indusium rather small, persistent hairy.

Frequent in moist, rather shady places in lowlands near streams and swampy areas.

Fertile: July.

Distribution: JAVA, SUMATRA, MALAYA, INDIA.

Specimens examined: Jamir 6193 Changki/Tzulu (Mokokchung dist , 250 m).

There is a considerable range of variation in size of frond and in depth of crenation of pinnae.

Pronephrium lakhimpurense (Rosc.) Holttum in Blumea 20(1): 110. 1971; Baishya & Rao, Ferns & Fern-allies Meghalaya 85. 1982.

Dryopteris lakhimpurensis Rosc., Meded. Rijksherb. 31: 7. 1917.

Meniscium cuspidatum var. longifrons Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 572. 1880.

(Plate 90)

Rhizome up to 0.2 cm in diam, long-creeping. Stipes about 40 - 90 cm long, glabrous, pale-brown. Lamina 50 - 150 x 25 - 60 cm or more, simple pinnate; lateral pinnae 7 - 10 pairs, alternate, sessile or shortly petiolate, usually tapering and suddenly narrowed to a long acuminate-caudate apex, margin entire or slightly undulate; texture subcoriaceous, reddish-brown when dry; rachises and midribs glabrous, smooth, brownish; main veins prominent, usually areoles 10 - 20 pairs between midrib and margin, almost all anastomosing; excurrent veins often free. Sori exindusiate, superficial along veins; sporangia lacking setae.

Rare; usually grows in moist, humus soils and shady places in forests, specially near streamlets and river banks.

Fertile: July - October.

Distribution: SRI LANKA, BURMA, THAILAND, JAPAN, CHINA, TONKIN, INDIA - North East India, Meghalaya at 1400 m elevation.

Specimens examined: Jamir 6192, 7222, 7976 Changki Mokokchung dist., 1000 m); 6210 Mepongchuket (Mokokchung dist., 1300 m) ; 6553 Mon (Mon dist., 898 m).

Pronephrium nudatum (Roxb.) Holttum in Blumea 20 (1): 111 - 112. 1972.

Polypodium nudatum Roxb. in Calc. J. nat. Hist. 4: 491. 1844; Dhir, Ferns N.W. Himalayas 105. 1980; Baishya & Rao, Ferns & Fern -allies Meghalaya 85. 1982.

P. multilineatum Wall. ex Hook. Sp. Fil. 5: 11.1863.

Thelypteris multilineata (Wall. ex Hook.) Morton in Amer. Fern J. 49(3): 113. 1959; Nayar in Rec. bot. Surv. India 20(2): 16. 1973.

Nephrodium moulmeinense Bedd., Ferns Brit. India 18. 1876; et Handb. Ferns Brit. India Suppl. 73. 1892.

Abacopteris multilineata (Wall.) Ching in Bull. Fan. Mem. Inst. Biol. Bot. 8: 253. 1938.

Aspidium multilineatum Wall., Cat. 1828 (nom. nud.); Holttum, Fl. Malaya 2: 297. 1968.

(Plate 91)

Rhizome up to 2 cm in diam, stout, wide-creeping, Stipes up to 70 cm or more long, rather stout, distant on rhizome, sparsely scaly at base, glabrous above. Lamina up to 110 x 70 cm, unipinnate; lateral pinnae up to 13 pairs, alternate, or subopposite, sessile and with a single terminal pinna similar to lateral ones; largest pinna about 20 - 45 x 2 - 5 cm, broadly cuneate at base, gradually tapering into an acuminate apex, margin sharply crenate, strongly cartilaginous or slightly toothed; texture thin but firm, coriaceous; lower surfaces of lamina pustular, variously hairy; upper surface hairy on costa only, veins 15 - 20 pairs, free excurrent veins rare. Sori small, round, medial; indusia small, with few hairs, often rudimentary; sporangia glabrous; spores dark, exine with short spines.

Very common throughout the state; grows on moist, shady places in high and lowland forests; often abundant near streamlets and rivers.

Fertile: July - October.

Distribution: BURMA, THAILAND, TONKIN, CHINA, MALAYA, INDIA - North Western Himalayas, Meghalaya.

Specimens examined: Jamir 6166 Changki (Mokokchung dist., 1000 m); 6653 Mon (Mon dist., 898 m); 6678 Tejit (Mon dist., 200 m); 6555 Chumuketema (Kohima dist., 240 m).

Phonephrium triphyllum (Sw.) Holttum in Blumea 20 (1): 122. 1972; et Fl. Malaya 2: 287. 1968; Chen-meng Kuo, Fl. Taiwan 1: 431 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 86. 1982.

Meniscium triphyllum Sw. in Schrad. J. Bot. 1800; 2: 16. 1801.

(Plate 92)

Rhizome up to 0.5 cm across, slender, wide-creeping, fronds 1 - 3 cm apart, more or less dimorphic. Stipes about 7 - 45 cm long, slender, pale-purplish, grooved, covered with short hairs, scaly at base, scales about 0.3 cm long, dark-brown, linear-lanceolate, hairy; stipes of fertile fronds usually longer and narrower than sterile ones. Lamina 10 - 25 cm long, trifoliate; the lateral pair of pinnae about 5 - 12 x 1.5 - 2.5 cm, oblanceolate, opposite, petiolate (petiole about 0.3 cm long), slightly oblique and attenuate at base, widest somewhat in middle, gradually tapering into an acuminate apex, margin entire or irregularly undulating; the single terminal pinna somewhat largest, up to 15 x 4 cm, gradually attenuate or sometimes auricled to cuneate at base, wide in middle, gradually tapering into an acuminate apex, margin similar

to lateral ones; texture coriaceous, upper surface of lamina rather sparsely covered with short hairs, but costae more densely hairy; lower surface of costae and lateral veins densely hairy; veins prominently raised, reticulate, excurrent veinlet free or united to the next pair of veins above. Sori exindusiate, along almost the whole length of the veins, sporangial setae hooked.

Not common; rather in exposed forests in lowlands; sometimes along streams and river banks.

Fertile: February.

Distribution: SRI LANKA, BURMA, THAILAND, MALAYA, CHINA, JAPAN, AUSTRALIA, INDIA - Meghalaya.

Specimens examined: Jamir 7021 Changki Tzulu (Mokokchung dist., 240 m).

Pronephrium triphyllum var. parishii (Bedd.) Kuo in Fl. Taiwan 1: 431. (ed. 2). 1980.

Meniscium parishii Bedd., Ferns Brit. India 399. 1883.

Abacopteris triphylla var. parishii (Bed.) Ching in Bull. Fan. Mem. Inst. Biol. Bot. 8: 242. 1938.

Pronephrium parishii Holttum in Blumea 20 (1): 123. 1972.

(Plate 93)

Rhizome up to 0.5 cm across, slender, wide-creeping. Fronds usually dimorphic. Stipes about 15 - 40 cm long, slender, pale-brown, short hairy throughout, sparsely scaly at base; scales about 9.5 x 0.2 cm, dark-brown, linear-lanceolate, acuminate. Lamina 20 - 40 x 10 - 15 cm, simple pinnate, ovate-lanceolate in outline; lateral pinnae 2 - 5 pairs, alternate, adnate or sessile, except the lowest pair which is shortly petiolate; terminal pinna similar in shape to the lateral ones except slightly enlarged; largest pinnae up to 16 x 4 cm, oblanceolate, oblique or attenuate at base, broadest somewhat in middle, suddenly narrowed to a lanceolate acuminate apex, margin entire or irregularly undulate, texture subcoriaceous, glabrous above, except shortly hairy on the midrib, more densely covered with pale-hooked hairs beneath on the midrib and veins; veins prominently raised, areoles 10 - 13 pairs from midrib to margin, excurrent veinlets free or united to the next pair of veins above. Sori exindusiate, along the veins; sporangial setae hooked at the tip.

Rare, collected only once on moist humus covered soils and along shady banks of streams and rivers.

Fertile: February.

Distribution: MALAYA, SRI LANKA, TONKIN, TAIWAN, INDIA - North Eastern India.

Specimens examined: Jamir 7031 Changki Longnakza-imgpang (Mokokchung dist., 240 m).

13. Christella

Lev., Fl. Dekauy-techeou 472. 1915.

Terrestrials. Rhizome creeping, erect or suberect, scales on rhizome linear, narrow-lanceolate with many superficial setae or hairs. Fronds pinnate or bipinnatifid with lobed pinnae; lower pinnae gradually reduced and almost all cases auricled on the acroscopic base, aerophores at the base of reduced pinnae not swollen; largest pinnae shallowly to deeply lobed, provided with erect, acicular hairs on the lower surface, as well as between the veins on the upper surface, often capitate hairs present; sometimes lower surface of costules and veins covered with thick orange red glandular hairs; veins free or in most cases at least the basal veins of adjacent costules anastomosing, sometimes many pairs. Sori usually indusiate; sporangia lacking hairs or glands near annulus but with unicellular elongate glandular hairs on the stalk; spores dark, variously tuberculate or ridged, lacking thin wings.

A genus comprising of about 40 species; 6 in Nagaland.

K E Y T O S P E C I E S

1a. Only a basal pair of veins anastomosing.

2a. Basal pinnae not or very slightly reduced.

3a. Stipes densely scaly; glandular hairs abundant between veins on lower surface . . . . . cylindrothrix

3b. Stipes not scaly; glandular hairs absent on lower surface . . . . . parasitica

2b. Basal pinnae conspicuously reduced.

4a. Rhizome creeping; pinnae deeply lobed upto costa; rachis conspicuously raised on the lower surface . . . . . appendiculata

4b. Rhizome erect; pinnae shallowly lobed or dentate; rachis not conspicuously raised on the lower surface . . . . . dentata

1b. More than 1 pair of veins anastomosing;

5a. Basal pinnae conspicuously reduced; stipe and rachis pubescent . . . . subpubescens

5b. Basal pinnae not or very shortly reduced; stipe and rachis glabrescent ..acuminata

Christella acuminata (Houtt.) Lev., Fl. Kouy-techeuo 476. 1915; Holttum in Kew Bull. 31(2). 333 - 334. 1976; Baishya & Rao, Ferns & Fern-allies Meghalaya 80. 1982.

Polypodium acuminatum Houtt., Nat. Hist. 14: 181, t. 99. f. 2. 1783.

Rhizome rather long-creeping, slender, the apex covered with dark-brown, linear-lanceolate, hair-tipped scales; scales about 0.7 cm long. Stipes 10 - 30 cm long, scaly at base and more or less densely covered with pale hairs throughout. Lamina 25 - 40 x 10 - 18 cm or more; lateral pinnae about 10 pairs or more, alternate, sessile with a single terminal pinna about 15 x 2.5 cm, similar to lateral ones but larger with a long lanceolate, acuminate apex; the lowest pair of pinna more widely spaced but somewhat shortened; largest pinnae up to 10 x 2 cm, oblanceolate, sessile, basal acroscopic lobe enlarged and curved towards the rachis, more or less lobed 1/2 to costa; lobes up to 0.5 cm wide, entire, obtuse or acute at apex; rachis covered with pale-hairs; veins usually 7 - 10 pairs, lowest pair anastomosing, next pair runs to sinus membrane, prominent on both surface, simple except in the basal auricle of pinnae; lower surface of costae and costules more or less covered with hairs, glandular hairs lacking; upper surface covered with very short hairs on costule, veins and in between veins. Sori medial or a little supramedial; indusia large, copiously short-hairy.

Rather common in moist, shady places in forests.

Fertile: October - December.

Distribution: JAPAN, TAIWAN, CHINA, INDIA - Meghalaya.

Specimens examined: Jamir 6680 Tejit (Mon dist., 200 m); 6485, 7951 Kohima (Kohima dist., 1445 m); 6219 Changki (Mokokchung dist., 1000 m).

Christella appendiculata (Presl.) Holttum in Kew Bull. 31(2): 311. 1876.

Nephrodium appendiculatum Presl, Epim. Bot. 47.1851.
Aspidium molliusculum Kuhn.; Baishya & Rao, Ferns & Fern-allies Meghalaya 80. 1982,
Nephrodium extensum var. microsorum Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 530. 1880.
N. microsorum (Clarke) Bedd., Handb. 270. 1883, non. Hook. 1862.
N. molliusculum (Bedd.) C. Chr., Ind. Fil. 278. 1905.
Thelypteris molliuscula (Bedd.) K.Iwats. in Hara Fl. East. Himal. 484. 1966, excl. Syn. Aspidium molliusculum Kuhn.

Rhizome short to creeping. Stipes 30 - 50 cm or more long, pale or flushed with red, clothed with linear-lanceolate, brownish, hair-tipped scales; scales up to 1 cm

or more long; lamina 30 - 70 x 15 - 30ccm, pinnate, pinnae 20 - 30 pairs, basal pair conspicuously reduced to basal crenate auricle, the second pair slightly reduced; largest pinnae up to 22 x 2.5 cm, sessile, subtruncate at base, gradually tapering into lanceolate-acuminate apex; margin deeply cut down 1/2 way or almost quite to costae into lobes; lobes up to 0.4 cm wide, obtuse or rounded at apex, margin entire, rather oblique to costae, subfalcate; texture thin but firm; rachises, costae and veins clothed with short hairs on lower surface, hairs absent in between veins, often with capitate hairs on costules, veins and surface; hairs on upper surface of costae and costules thicker with short acicular hairs; veins 8 - 12 pairs on each lobe, basal pair anastomosing with short excurrent vein to sinus, others reaching up to margin. Sori medial, brown, in two rows, one on either side of costule, basal ones sometimes divargent, indusia small, pale-brown, hairy.

Frequent near streams and river sides.

Fertile: January - May.

Distribution: INDIA - Himalayan foothill region, Assam at 150 - 1500 m.

Specimens examined: Jamir 7288, 7289 Kohima Science College road (Kohima dist., 1500 m); 7166 Changki (Mokokchung dist., 1000 m).

Christella cylindrothrix (Rosenst.) Holttum in Nayar & Kaur, Companion to Beddome: 208. 1974; et in Kew Bull. 31(2): 308. 1976; Baishya & Rao, Ferns & Fern-allies Meghalaya 80. 1982.

Dryopteris cylindrothrix Rosenst. in Fedde, Report. 12: 246. 1913.

Cyclosorus cylindrothrix (Rosent.) Ching in Bull. Fan. Mem. Inst. Biol. Bot. 8: 199. 1938; Mehra & Dixit in J. Bomb. nat. Hist. Soc. 78: 450. 1981.

Thelypteris cylindrothrix (Rosent.) K.Iwats. in Hara Fl. East. Himal. 482. 1966.

Nephrodium parasiticum var. aureum Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 533. 1880.

Dryopteris assamica Rosent. in Meded. Rijksherb. Leiden 31: 6. 1917.

Nephrodium molle var. aureum (Clarke) Bedd., Handb. 279. 1883.

Rhizome up to 0.4 cm wide, short to long creeping, rather stout. Stipes 25 - 50 cm long, tufted or well spaced, pale-brown to reddish, more or less densely covered with dark-brown, thin, linear-lanceolate scales at base, rather sparse above; scales up to 1 x 0.2 cm; lamina about 30 - 60 x 20 - 35 cm, pinnate; lateral pinnae numerous, about 15 - 22 pairs, close, alternate, sessile, the lowest basal pair of pinnae slightly reduced to above or not;

largest pinnae 10 - 23 x 1.5 - 2.5 cm, sessile, truncate to subtruncate at base, gradually tapering into caudate-acuminate apex, margin almost deeply cut down towards costa into lobes; lobes up to 0.4 cm wide at base, oblique, slightly falcate, round or bluntly pointed at apex, margin entire or slightly crenate, texture thin but firm; rachis shortly scaly or hairy; lower surface of lamina more or less deeply clothed with a variable number of short, acicular hairs and also many thick glandular hairs on and between veins; costae, costules and veins, bearing short hairs on the upper surface; veins up to 8 - 12 pairs, pinnate on each lobe, the lowest pair anastomosing with short, excurrent veins to sinus. Sori medial, or submarginal in two rows, one on either side of costule; indusia bearing both acicular and glandular hairs.

Rare; prefers to grow in moist, shady forests along hill slopes and river banks.

Fertile: November - January

Distribution: BHUTAN, BURMA, THAILAND, INDIA - Assam Sikkim, Meghalaya.

Specimens examined: Jamir 6214 Changki (Mokokchung dist., 1000 m).

✓Christella dentata (Forsk.) Brownsey et Jermy in Brit. Ferns Gaz. 10: 338. 1973; Holttum in Kew Bull. 31(2): 314 - 316. 1976; Kuo, Fl. Taiwan 1: 404 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 81. 1982.

Polypodium dentatum Forsk. Fl. Aegypt-Arab. 185. 1775.

Nephrodium molle sensu Bedd. Handb. Ferns Brit. India 277. 1883 (pro parte); Hope J. Bomb. nat. Hist. Soc. 14: 746. 1902.

Cyclosorus dentatus (Forsk.) Ching in Bull. Fan. Mem. Inst. Biol. 8: 206. 1938; Dhir, Ferns N.W. Himalayas 103. 1980.

Rhizome short-creeping to erect, apical portion densely covered with pale-brown, linear-lanceolate scales; scales up to 1 x 0.1 cm, Stipes 12 - 45 cm long, scaly at base, glabrous above or with scattered, very short hairs or pubescent; lamina up to 60 x 25 cm or more long, oblanceolate in outline, pinnate; lateral pinnae numerous, about 16 -25 pairs, subopposite, to alternate, sessile, 2 - 4 pairs of lower pinnae shorterned and sometimes deflexed, up to 3 - 5 cm long, distant; auricled at acroscopic base; auricle again lobed; largest pinnae up to 12 x 2 cm or more, truncate at base, gradually tapering into lanceolate-acuminate apex, margin cut down 1/2 way towards the costae into lobes; lobes about 0.4 cm wide, slightly oblique or subfal-

cate, entire, rounded at apex, texture thin but firm; rachis and costae more or less densely clothed with short, spreading hairs, costules and veins with shorter spreading hairs on the lower surface; the surfaces of the lamina minutely pilose, veins 6 - 9 pairs, pinnate on each lobe, the lowest veins (rarely two) from adjacent groups meet forming an excurrent veinlet running into sinus, the next acroscopic veins running to the side of the sinus membrane, the rest free up to the margins. Sori medial, arranged in two rows, one on either side of the costule; indusia rather large, brown, persistent, entire, glabrous or hairy.

Abundant, along river courses and streamlets in forests, forming dense patches.

Fertile: July - December.

Distribution: Throughout the tropics and subtropics of the world; throughout India from plain up to 1800 m altitude.

Specimens examined: Jamir 6054 Peren (Kohima dist., 1446 m); 6039 Rangapar forests (Kohima dist., 500 m); 6485, 7271 Kohima (Kohima dist., 1500 m).

✓ Christella parasitica (Linn.) Lev., Fl. Kouy-techeou. 475. 1915; Chen-meing Kuo, Fl. Taiwan 1: 406. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 81. 1982.

Polypodium parasiticum Linn., Sp. Pl. 1090. 1753.

Nephrodium parasiticum (Linn.) Desv. in Mem. Soc. Linn. Paris 6: 260. 1827; Clarke in Trans. Linn. Soc. Ser 2 (Bot.) 1: 533. 1880 (pro parte).

Cyclosorus parasitica (Linn.) Farw. in Amer. Midl. Nat. 12: 259. 1929; Holttum, Fl. Malaya 2: 281.f. 162. 1954.

Nephrodium procurrens (Mett.) Baker, Syn. Fil. 290. 1867; Bedd., Handb. Ferns Brit. India Suppl. 67. 1892.

Nephrodium didymosorum Parish ex Bedd., Ferns Brit. India t. 200. 1866.

Nephrodium molle var. didymosorum (Parish ex Bedd.) Bedd., Handb. Ferns Brit. India 279. 1883.

Nephrodium tectum Bedd., Handb. Ferns Brit. India Suppl. 79. 1892.

Cyclosorus didymosorum (Parish ex Bedd.) Nayar & Kaur, Companion to Bedd. Handb. 68. 1974.

Rhizome short to long creeping. Stipes 20 - 50 cm long, sparsely hairy or scaly at base; scales about 0.6 cm long, linear, lanceolate, more or less densely clothed with

short, soft hairs. Lamina 25 - 60 x 15 - 25 cm, broadly ovate to deltoid-lanceolate in outline; pinnae numerous, about 15 - 25 pairs, alternate or subopposite, sessile, the lowest pair usually deflexed, not or slightly reduced, auricled at acroscopic base, auricle curved towards rachis, often dentate; largest pinna up to 13 x 2 cm, linear-lanceolate, short acuminate; lobed 2/3 - 2/4 towards costa, lobes slightly oblique, texture subcoriaceous; lower surfaces of lamina covered with pale, soft, spreading hairs; veins in the lobes sometimes with orange, glandular hairs; upper surface covered with thick, acicular hairs, rather sparsely on costules and veins; veins 8 - 10 pairs, lowest pair joining to form an excurrent vein to sinus membrane, next veins running to edge or sometimes the acroscopic one to side of sinus-membrane. Sori medial or submarginal, lower ones divargent, basal on veins from adjacent costules, sometimes touching; indusia hairy.

Common in moist, shady and forest cleared hill slopes; sometimes near ditches and streamlets.

Fertile: October - December.

Distribution: CHINA, TAIWAN, JAPAN, SRI LANKA, THAILAND, MALAYA, FIJI, NEW CALEDONES, AUSTRALIA, HAWAII, INDIA - Southern and Nort East India; Meghalaya at 1990 m elevation.

Specimens examined: Jamir 6535 Wokha (Wokha dist., 1314 m); 6453 Zehheboto (Zenheboto dist., 1874 m).

Christella subpubescens (Blume) Holttum in Kew Bull. 31(2): 323. 1976; Baishya & Rao, Ferns & Fern-allies Meghalaya 82. 1982.

Aspidium subpubescens Blume, Enum. Pl. Jav. 149. 1828.

Cyclosorus latipinna (Benth.) Tard. in Notul. Syst. 7: 73. 1938; Holttum, Fl. Malaya 2: 276, f. 159.1954.

Nephrodium molle var major Bedd., Handb. Ferns Brit. India Suppl. 76. 1892.

Nephrodium molle var. amboinense Bedd., Handb. Ferns Brit. India 278. 1883 (pro parte).

Cyclosorus sumatranus (V A. V R) Ching in Bull. Fan. Mem. Inst. Biol. Bot. 10: 249. 1941; Holttum, Fl. Malaya 2: 275. f. 158. 1968.

Rhizome short-creeping or suberect; roots wiry, wide spreading. Stipes 10 - 25 rm long, glabrous or sparsely hairy, pale-brown. Lamina 50 - 90 x 15 - 25 cm, unipinnate; pinnae numerous, about 15 - 25 pairs, alternate or subopposite, sessile, the lowest 2 - 8 pairs gradually reduced and deflexed, broadest somewhat near middle and the upper gradually tapering, ending with a single terminal deeply lobed pinna; the lowest about 3 cm long, with basal acroscopic lobe usually much enlarged with forked or

anastomosing veins; largest pinnae up to 15 x 3 cm, truncate at base, gradually tapering to lanceolate, acuminate, entire apex; margins usually lobed less than or 1/2 way towards costa; lobes up to 0.8 cm wide at base, rather falcate, obtuse or rounded, texture thin, subcoriaceous; lower surface of the lamina short hairy; upper surface of rachis, costae, costule and veins clothed with acicular hairs; veins 5 - 9 pairs, simple, free except 1 - 2 pairs anastomosing with an excurrent veinlet below the sinus; immediate next pair runs to the margins of sinus membrane. Sori medial on the veins, in 2 rows on either side of the costule; indusia rather large, brown, entire, minutely hairy.

Common in moist, shady places on forested hills.

Fertile: July - December.

Distribution: CHINA, BURMA, THAILAN, VIETNAM, MALAYA, QUEENSLAND, INDIA - North East India, Meghalaya.

Specimens examined: Jamir 6681 Tejit (Mon dist., 200 m); 6071 Peren (Kohima dist., 1446 m).

14. Pneumatopteris

Nakai, Bot. Mag. Tokyo 47, 179. 1933; Holttum in Blumea 19(1): 42. 1971.

Rhizome usually erect or suberect, sometimes long creeping. Stipes sparsely hairy, scaly; scales broad, thin with marginal hairs and rarely with superficial hairs. Fronds usually large with many pinnae; the lowest basal pair much shortened, usually to many pairs, transition from normal to reduced pinnae abrupt or rarely quite gradual; aerophores at bases of lower pinnae swollen, white on young fronds, often much elongate; pinna lobes with cartilaginous margins which are often toothed at the ends of veins; veins usually anastomosing, sometimes free with deeply lobed pinna, usually the basal veins from adjacent costules anastomosing to form an excurrent vein to a sinus membrane; lower surface of rachis, costae and other parts never densely long hairy, sometimes with short, acicular or capitate hairs, sessile glands absent. Sori usually indusiate; sporangia often bearing short, club-shaped glandular hairs, rarely setae; sporangial stalk with a hair of 3 or 4 cells, terminal cell enlarged but not spherical; spores light-brown with many, small, thin, quadrate wings; exine spinulose.

A genus comprising of about 20 species; 1 in Nagaland.

Pneumatopteris truncata (Poir.) Holttum in Blume 21(2): 314. 1973; Chen-meng Kuo, Fl. Taiwan 1: 427. (ed.2) 1980.

Polypodium truncatum Poir., Encycl. Meth. 5: 534. 1804.

Cyclosorus truncatus (Poir.) Fauo. in Amer. Natur. 12: 150. 1931.

Rhizome short, erect or ascending. Fronds tufted. Stipes up to 60 cm long, stout, straminous, sparsely covered with broad, pale-brown, thin scales. Lamina up to 120 x 40 cm, simple pinnate; lateral pinnae numerous, alternate, sessile, lower pinnae abruptly shortened, up to 8 pairs, sometimes almost nearly to the base; lower pinnae norma; largest pinnae up to 25 x 3 cm, broadly cuneate or somewhat truncate, gradually tapering into an acuminate apex, margin cut down about 1/3 way to costae into lobes; lobes up to 0.5 cm wide at base, truncate to subtruncate, bluntly toothed; rachis and costae sparsely clothed with short hairs beneath; lamina subcoriaceous, the lower surface bearing pustular swellings when dry, texture thin, subcoriaceous; veins about 10 pairs in each lobe, 1 - 2 pairs anastomosing next pair to sides of sinus membrane. Sori inframedial, lower ones not divargent; indusia glabrous, entire; usually shrivelled at maturity; sporangia with minute, capitate hairs near annulus.

Not common; in open places near streams and river banks and also in shady, natural forests.

Fertile: May - December.

Distribution: SRI LANKA, CHINA, MALAYA, PHILIPPINES, POLYNESIA, AUSTRALIA, TAIWAN, INDIA - Both in South and North India.

Specimens examined: Jamir 7997, 7970, 7114 Changki (Mokokchung dist., 1000 m).

15. Sphaerostephanos

J. Smith in Hook. Gen. Fil. t. 24. 1839; C. Chr., Ind. Fil. 623. 1906; Copel., Gen. Fil. 144. 1947; Holttum in Blumea 19(1): 39. 1971.

Rhizome erect to semierect, rarely long creeping, scales usually narrow, bearing acicular hairs on margin and surface. Fronds with much reduced basal pinnae; aerophores at pinnae bases sometimes swollen or elongate, apex of frond rarely pinna-like; pinnae almost lobed, or rarely subentire, sinus membrane almost always distinct; veins anastomosing or free or just meeting at the sinus; both surfaces with sessile spherical glands, rarely absent; acicular hairs usually present on both surfaces of costae and costules, often on lamina between veins. Sori round,

sometimes elongate, indusiate or not; indusia small, thin, often hairy or glandular, rarely vestigial; sporangia usually bearing spherical glands or setae near annulus; stalk hairy; spores light-brown, exine spinulose or bearing translucent wings.

A large genus with about 120 species; 2 species in Nagaland.

K E Y T O S P E C I E S

Rhizome wide-creeping; stipe appressed hairy; pinnae subopposite or alternate... unitus

Rhizome short-erect; stipe usually glabrous; pinnae alternate . . heterocarpum

Sphaerostephanos heterocarpum (Blume) Copel. Univ. Calif. Publ. Bot. 16: 60. 1929; Holttum, Blumea 29(1): 40. 1971.

Aspidium polycarpum Blume, Enum. Pl. Jav. 156.1828.

Mesochlaena polycarpa Bedd., Ferns Brit. India t. 344. 1866; et Handb. Ferns Brit. India 199. 1883.

Cyclosorus polycarpus (Blume) Holttum Fl. Malaya 2: 283. 1968.

Rhizome short-erect. Stipes up to 60 cm long, tufted, stout, scaly at base, usually glabrous above or shortly hairy; lamina 30 - 70 x 15 - 25 cm, oblanceolate in outline, pinnate, lateral pinnae 20 - 25 pairs alternate, close, sessile, some lower pairs gradually narrowed towards the base of the stipe, often auricled on the acroscopic side; largest pinnae up to 15 x 1.5 cm or more, the base subtruncate or cuneate with the basal lobes or segments slightly elongate on the acroscopic side (often basioscopic side), gradually tapering into an acuminate apex, entire or slightly undulate, margin cut down almost quite to the costa into lobes; lobes up to 0.4 cm wide at base, linear-oblong, bluntly pointed at apex, oblique, slightly falcate; texture thin but firm; rachis, costa and costules usually clothed with pale, short hairs on the lower surface, glabrous above or sparsely hairy; veins up to 8 - 13 pairs or more; distinct, pinnate, close on each lobe, oblique, simple, only the lowest pair pf veins anastomosing forming an excurrent vein which runs to the base of the sinus membrane, the rest above free up to the margin of the lobes. Sori small, brown, medial, close ultimately confluent; indusium reniform, small, brown; sporangia brown, shortly stalked.

Frequent, prefers to grow in moist, somewhat shady places near streams and river banks.

Fertile: January.

Distribution: BURMA, CHINA, MALAYA, SRI LANKA, TAIWAN, INDIA - South India.

Specimens examined: Jamir 7290 Kohima (Kohima dist., 1500 m).

Sphaerostephanos unitus (Linn.) Holttum in J. South Afr. Bot. 40: 165. 1974; Baishya & Rao, Ferns & Fern-allies Meghalaya 87. 1982.

Polypodium unitum Linn., Syst. Nat. ed. 10, 2: 1326. 1759.

Cyclosorus unitus Ching in Bull. Fan. Mem. Inst. Biol. Bot. 8: 192. 1938.

Thelypteris unita Morton in Amer. Fern J. 49: 113. 1959;

Aspidium cucullatum Blume, Enum. Pl. Jav. 2151.1828.

Aspidium unitum Sieb. ex Mett. Farngatt. Aspid. 107. 1858.

Nephrodium cucullatum Baker in Hook. Syn. Fil. 290. 1867; Bedd., Ferns Brit. India 271. 1883; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 530. 1880.

Rhizome wide-creeping, apex covered with narrow, pale-brown scales. Stipes 25 - 50 cm long, slender, scaly at base, more or less densely clothed with short, appressed hairs, sometimes glabrous at maturity. Lamina 40 - 60 x

20 - 30 cm, simple pinnate; pinnae numerous, 15 - 30 pairs, subopposite or alternate, sessile, rather oblique, the lowest 3 - 5 pairs much shortened, auricled at base of acroscopic side; largest pinnae up to 25 x 2.5 cm, linear, oblanceolate, unequal, cuneate at base; gradually tapering into acuminate apex, margin cut down 1/3 way towards the costae into lobes; lobes rounded, slightly oblique with shortly deltoid-acute apex, margin entire or shallowly undulate; texture subcoriaceous, rigid; rachis densely clothed with short, pale-hairs and a few scales beneath; with rather long, spreading hairs above; costae clothed with short appressed hairs on both surfaces; veins 7 - 12 pairs, prominently raised beneath, the lower two basal pairs anastomosing, the next two pairs above meeting the hyaline membrane closing the lowest part of sinus. Sori rather small, medial, almost to apices of veins, indusiate; indusium reniform, small, brown, entire, with a few hairs and glands.

Common in moist, usually exposed places in forests; also near rivers and streams, usually in swampy areas.

Fertile: July - October.

Distribution: TROPICAL ASIA, AFRICA, AUSTRALIA, AMERICA, MALAYA, INDIA - Throughout the Indian region.

Specimens examined: Jamir 6189 Changki Tzulu (Mokokchung dist., 250 m); 6389 Mezenkong forests (Mokokchung dist., 1325 m); 6634 Mon (Mon dist.,898 m); 6670,6406 Tijit (Mon dist.,200 m); 6041 Dimapur (Kohima dist., 200 m).

30. ASPLENIACEAE

Terrestrials or epiphytic ferns. Rhizome short, creeping or erect, dictyostelic, usually clothed with clathrate, dark-brown or black, narrowly lanceolate, scales; usually hairs also present; stipes tufted, not articulate to rhizome, with 2 vascular strands at base, uniting to form an 'X' shaped strand in upper stipe, margins of the bases ofpinnae continuous with rachis groove; lamina simple, pinnate to decompound; veins usually free, forked, without included veinlets. Sori linear, rather long, borne on one side of the veins; indusia linear-narrow, attached along the veins, opens towards midrib of the leaflets; often indusia vestigial or absent; sporangia long stalked; annulus incomplete, vertical; spores bilateral, with perispore.

A family with about 17 genera; 1 in Nagaland.

Asplenium

Linn. Sp. Pl. 1078. 1753; Copel., Gen. Fil. 163. 1947.

Characters of the family.

One of the largest genera of ferns with about 650 species; 17 species in Nagaland.

K E Y T O S P E C I E S

1a. Fronds simple.

2a. Lamina less than 2 cm broad . . . . ensiforme

2b. Lamina more than 4 cm broad.

3a. Spores smooth; fronds 8 - 15 cm wide . nidus

3b. Spores spinulose; fronds 5 - 8 cm wide . . . . . phyllitides

1b. Fronds compound.

4a. Fronds unipinnate; pinnae serrate or cut to various length.

5a. Sori small, confined to lobes, distal on veins . . . . . cheilosorum

5b. Sori on the pinnae, not confined to lobes.

6a. Terrestrials; rachis and stipe compressed; pinnae only 2 - 3 pairs, broad, entire or nearly so; sori 1 - 2.5 cm long . . finlaysonianum

6b. Epiphytes or terrestrials; stipes and rachis not compressed; pinnae more than 3 pairs, variously lobed.

7a. Pinnae incised, variously cleft or entire; epiphytes.

8a. Apex of pinnae lobes obtuse or round.

9a. Pinnae 1 - 1.2 cm broad, lobes shallow; sori many . . . . . indicum

9b. Pinnae less than 1 cm broad, variously, deeply lobed; sori few . . rockii

8b. Apex of pinnae lobes subacute or acute.

10a. Midrib of pinnae grooved above; pinnae 5 - 6 cm long, up to 30 pairs. . . perakense

10b. Midrib of pinnae not grooved; pinnae 2 - 3 cm long, up to 22 pairs . . . . tenerum

7b. Pinnae not incised, only serrate or dentate or entire; terrestrials.

11a. Pinnae irregularly dentate; upper base conspicuously raised; sori oval, 0.4 - 0.6 cm.

12a. Pinnae 4 - 8 x 1 - 1.5 cm . . . unilaterale

12b. Pinnae 2 - 2.5 x 0.5 - 0.8 cm,..unilaterale var. delicatulum

11b. pinnae wavy or undulate; upper base not conspicuously raised; sori narrow-linear, 1 - 1.5 cm long . . . . . paradoxum

4b. Fronds bipinnate or bipinnatifid or tripinnatifid.

13a. Lamina tripinnatifid . . . . . tenuifolium

13b. Lamina bipinnate or bipinnatifid.

14a. Lamina bipinnate; lobes broad.

15a. Epiphytes; main rachis terete, black and shining; stalk and pinnae not winged . . . . . nitidum

15b. Terrestrials; main rachis compressed, not polished; stalk and pinnae winged . bullatum

14b. Lamina bipinnatifid (sometimes only unipinnate) lobes narrow.

16a. Terrestrials or on rocks; stipe and rachis densely black scaly throughout . . sarelii

16b. Epiphytes or on rocks; stipe and rachis otherwise.

17a. Incision of acroscopic basal segment more than 4 times; lobes deeply cut, linear-subulate . . . . . rockii

17b. Incision of acroscopic basal segment not deep, margin lobed, lobes finely crenate . . . . . laciniatum

Asplenium bullatum Wall. (List no. 215. 1828. nom.nud) ex Mett. in Abh. Sendhenb, Ges. Frankfurt. 3: 150. 1859; Tagawa in Acta Phytotax. Geobot. 14: 598.1936. DeVol & Kuo in Fl. Taiwan 1: 479. (ed. 2). 1980.

(Plate 94)

Rhizome short, erect, clothed with hair-tipped scales; scales about 1 x 0.2 cm. Stipes 15 - 20 cm long, erect, greenish, with lanceolate, alternate scales at base, glabrous above or slightly hairy; rachis and costae glabrous, narrowly winged, greenish; lamina 25 - 40 x 6 - 10 cm, anadromous, tri-quadripinnatifid; lateral pinnae 20 - 25

pairs, alternate; the basal pinnae slightly reduced to the next one, the upper ones gradually reduced, ending to a delto-lanceolate apex; the largest pinnae up to 5 x 2 cm, cut down into many, lanceolate deltoid pinnules; the basal pinnules up to 1.5 x 1 cm, shortly petiolate or slightly decurrent to the rachis, cut down slightly into 2 - 4, linear, oblong, flaccid lobes, with slightly acuminate apex; texture herbaceous; veins forked once or more. Sori up to 0.4 cm long, linear, brown, oblique to the costae, one on each lobe, usually not reaching the margins, often spreading on the whole lobe; indusia 3 mm wide, entire, pale-green to whitish; spores pale-brown, translucent.

Frequent on hill slopes in forests; sometimes on humus covered rocks and tree trunks.

Fertile: December.

Distribution: North India.

Specimens examined: Jamir 7914 Kohima (Kohima dist., 1445 m).

✓Asplenium cheilosorum Kuntze in Mett. Farngatt. Asid. 133, t. 5, f. 12 - 13, 1859; Holttum, Fl. Malaya 2: 435. 1954; DeVol & Kuo in Fl. Taiwan 1: 481. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 113. 1982.

Asplenium heterocarpum Wall. ex Hook., Sp. Fil. 3: 132. t. 175. 1860; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 481. 1880; Bedd., Handb. Ferns Brit. India 153, t. 77. 1883.

(Plate 95)

Rhizome about 0.5 cm thick, hard, creeping, clothed with narrow, dark-brown, ovate-lanceolate, broad based, hair-tipped scales; scales about 0.5 x 0.1 cm, stipes about 8 - 22 cm long, scattered, slender, dark-purplish, shining, glabrous except the scaly base; rachis glabrous, dark-purplish, grooved above; lamina 15 - 35 x 2 - 5 cm, simple pinnate, with about 30 pairs of pinnae on either side of the rachis; apex pinnatifid; lower pinnae shortly stalked, the upper ones rather abruptly reduced, forming narrow, oblique lobes at apex; pinnae up to 2.5 x 1 cm, dimidiate, deltoid oblong, the midrib close to the lower margin; lower margin entire, upper margin and apex crenate, toothed; the upper base truncate, margin lobed up to 1/3 of the width; the lobes each with 2 teeth; veins free, forked, slightly raised on both surfaces; sori up to 0.3 cm long, elongate, oblique-vertical to the costae, confined to the lobes, usually one or rarely two (facing away from

each other); indusia thin, light brown, reflexed at maturity, attached along the veins; spores light brown, opaque, with a thin, irregularly toothed , anastomosing wing.

Common on moist rock crevices along the banks of rivers and streams.

Fertile: July - February.

Distribution: JAPAN, TAIWAN, CHINA, VIETNAM, MALAYA, BURMA, SRI LANKA, INDIA - South India, Himalayas up to 1220 - 2500 m elevation, Meghalaya.

Specimens examined: Jamir 6101, 7926 Kohima (Kohima dist., 1445 m); 7003 Changki (Mokokchung dist., 1000 m).

✓Asplenium ensiforme Wall. ex Hook. & Grev., Icon.Fil. t. 71. 1828; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 476. 1880; Bedd., Handb. Ferns Brit. India 141. 1883; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.). 194. 1975; DeVol & Kuo, Fl. Taiwan 1: 482. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 113. 1982.

(Plate 96)

Rhizome short, erect, densely clothed with lanceolate, thin, dark-brown, hair-tipped scales; scales about 1 x 0.2 cm. Stipes up to 3 cm long, dark-brown, lanceolate, scaly at base; lamina 8 - 25 x 1 - 2 cm, simple, linear, glabrous,

margin entire or nearly so, apex acuminate, gradually narrowed at base and winged almost to base, costae raised on the surfaces; texture coriaceous; veins immersed, parallel once forked. Sori about 0.5 - 2 cm long, biseriate, linear, oblique to the midrib, nearly reaching the margins; indusia linear, entire, opening towards midrib; sporangia numerous, intermixed with multicellular hairs; spores globose, yellowish-brown.

Frequent in moist, dense forests.
Fertile : May
Distribution: SRI LANKA, CHINA, TAIWAN, JAPAN, BURMA, INDIA - South India; W. Himalaya - Garwhal up to 1220 - 2744 m elevations, and Meghalaya.

Specimens examined: Jamir 7154, 7131, 7158 Kohima (Kohima dist., 1445 m); 7167 Helipong forests (Tuensang dist.,1372 m).

Asplenium finlaysonianum Wall. ex Hook., Icon. Pl. t. 937 (1854.
(non. A. finlaysonianum Wall. List. n. 191. 1928).
Hemidictyum finlaysonianum Moore, Index Fil. 50. 1857; Bedd. Handb. Ferns Brit. India 195, t. 96. 1883.

(Plate 96A)

Rhizome short-creeping, stout, apex densely covered with black to dark-brown, linear-lanceolate, hair-tipped scales; scales up to 0.7 cm long. Stipes 10 - 25 cm long, green, subcompressed, glabrous except base; lamina 10 - 25 x 7 - 12 cm, or more long, usually pinnate, often simple; lateral pinnae 2 - 3 pairs, usually opposite or subopposite, with a single terminal pinna similar to lateral ones; the lowest pinnae up to 12 x 5 cm, gradually narrowed

towards base, broadest somewhat above the base, the apex suddenly narrowed to an acuminate-caudate, margin entire or irregularly lobed; texture leathery or coriaceous; rachis usually glabrous, green; lateral veins distinct, anastomosing, often obscure, sometimes bounded by an irregular, intramarginal line near margins. Sori up to 2.5 cm long, linear, oblique; indusia linear, margin entire.

Frequent ; grows on humus collected rocks near rivers and streamlets in dense evergreen forests. One of the very variable Asplenium spp. in Nagaland.

Fertile: December.

Distribution: BANGLADESH, MALAYA, INDIA - Assam, Meghalaya.

Specimens examined: Jamir 7227 Bakalabar forests/Dimapur (Kohima dist., 500 m).

✓ Asplenium indicum Sledge, in Bull. Brit. Mus. 3(6): 264. 1965; Dhir, Ferns N. W. Himalayas 109. 1981; Baishya & Rao, Ferns & Fern-allies Meghalaya 114. 1982.

Rhizome short-creeping, thick, erect with dense roots, densely clothed with blackish-brown, linear-lanceolate, hair-tipped scales; scales about 0.6 x 0.1 cm. Stipes 5 - 12 cm long, tufted, pale-green, to blackish-brown,

sparsely clothed with lanceolate, dark-brown scales; rachis similar to stipes; lamina 7 - 25 x 3 - 5 cm, simple pinnate, narrowly oblong-lanceolate; greenish-brown; lateral pinnae 7 - 20 pairs, parallel or slightly ascending to the rachis, the lowest basal pinnae slightly reduced, upper ones gradually tapering, ending in a narrow pinnatifid apex, alternate to subopposite, the largest pinnae 3 x 1.5 cm, petiolate (Petiole about 0.3 cm long), oblique, more or less rhomboidal, glabrous, with 2 - 4 deeply cut lobes, obliquely truncate at base, lower margin cut down to the midrib, entire, the upper margins and apex irregurly and often deeply incised; texture coriaceous; veins forked once or more, costa inconspicuous or lacking. Sori about 1 cm long, linear, almost continuous along the vein, oblique to the costae, indusia up to 0.3 cm wide, firm, pale-greenish to whitish, margin entire, linear; opens inwardsly; spores translucent.

Very common throughout the state in dense, shady forests.

Fertile: October - November.

Distribution: CHINA, TAIWAN, JAPAN, PHILIPPINES, INDIA - South India, Meghalaya.

Specimens examined: Jamir 6375 Morong forest (Tuensang 2134 m).

✓Asplenium lacineatum D. Don, Prodr. Fl. Nepal 8: 1825; Clarke in Trans. Linn. Soc. London Ser. 2 (Bot.) 1: 481. 1880 (pro parte); Bedd., Handb. Ferns Brit. India 154. 1883 (pro parte); Mehra & Bir, Res. Bull. Punjab Univ. (N.S.) 15: 157. 1964; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 194. 1975; Dhir, Ferns N.W. Himalayas 109. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 114. 1982.

Rhizome short, erect or slightly creeping, densely clothed with dark-brown, alternate, linear-lanceolate scales; scales about 0.5 cm long. Stipes 3 - 12 cm long, tufted, greyish-green, base densely covered by lanceolate scales, and sparsely above; rachis also with similar scales but very sparse; lamina 15 - 30 x 2 - 4 cm, bipinnatifid, with 25 pairs of pinnae, alternate or subopposite, basal ones slightly reduced than the next above; lateral pinnae 1 - 2 x 0.5 - 0.8 cm, rhomboidal, cuneate at base, inner edge truncate, acroscopic margin incised up to the costa, margin of the segments serrate or crenate, texture coriaceous; veins oblique, dichotomously forked, without a distnct costa. Sori up to 0.3 cm long, copious, linear, with 1 - 4 on each segment; indusia about 0.2 cm long, thin, pale-brown, elliptical, entire, opens somewhat towards the centre of segment.

Common on moist shady tree trunks in evergreen forests.

Fertile: May - July.

Distribution: TAIWAN, JAPAN, SRI LANKA, BHUTAN, INDIA - Western ghats, Himalayas, Garwhal, Meghalaya.

Specimens examined: Jamir 6160 Ptotsero (Phek dist., 2134 m); 7174 Helipong forests (Tuensang dist., 1372 m).

Asplenium nidus Linn., Sp. Pl. 1079. 1753; Holttum, Fl. Malaya 2: 419. (ed. 2). 1968; DeVol & Kuo in Fl. Taiwan 1: 485. 1980; Dhir, Ferns N.W. Himalayas 113. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 115. 1982.

(Plate 97)

Epiphytes. Rhizome short, stout, erect to suberect, apex clothed with thin, clathrate, broad-acuminate black to dark-purplish scales; scales about 1 x 0.3 cm or more, margin bearing numerous hair-like appendages. Stipes up to 5 x 0.7 cm, short, stout, dark to pale brown, glabrous except the scaly base; lamina 70 - 150 x 8 - 15 cm, simple, lanceolate, gradually narrowed at both ends, widest near middle, glabrous; midrib strongly raised on the upper surface, shining, dark-brown to pale-green, texture coriaceous, veins nearly parallel, forked once or twice. Sori linear, borne along each veinlet on upper half of the lamina, nearly reaching margin from midrib; indusia linear, narrow, superficially attached at base just above the veins,

opening outwards, slightly curved, greenish-grey; spores light brown, translucent when fresh, opaque when old; the wing irregularly thickened, somewhat anastomosing.

This is the 'Birdnest' fern, extremely common throughout the state in moist, dense forests; sometimes grows on humus soil as well as on moss-covered rocks. Naga people grow this plant for ornamental purpose.

Fertile: July - October.

Distribution: AFRICA, POLYNESIA, TAIWAN, PHILIPPINES, MALAYA, SRI LANKA, MADAGASCAR, TROPICAL ASIA, INDIA - North India, Meghalaya.

Specimens examined: Jamir 6689 Tejit (Mon dist., 200 m).

✓Asplenium nitidum Sw., Syn. Fil. 84. 1806; Bedd., Ferns South India 50, t. 147. 1863; et Handb. Ferns Brit. India 157. 1883; Clarke, Trans. Linn. Soc. Lond. Ser. 2 (Bot.) 1: 483. 1880; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim Himalayas 158. 1964.

(Plate 98)

Epiphytic. Rhizome stout, short-creeping, the apex densely clothed with thin, pale-purplish brown, hair-tipped scales; scales about 1 x 0.1 cm, roots soft, brown hairy. Stipes about 12 - 35 cm long, stout, erect, black to dark-

purplish, glabrous, smooth; rachis similar to stipes, slightly grooved above; lamina 10 - 30 x 5 - 10 cm, bipinnate, lanceolate; lateral pinnae 8 - 15 pairs, alternate or subopposite, the lowest basal pinnae rather smaller than the next, upper ones gradually reduced, ending into a small deltoid-lobed apex; the largest pinnae up to 6 x 3.5 cm, pinnate, lanceolate, with a deltoid-lobed apex, cut down to the rachis into numerous, stalked, subdeltoid, free pinnules; the largest pinnule up to 2 x 1.5 cm, shortly stalked, basioscopic lobe broadly cuneate, 2 - 3 or more deeply lobed; the lobes oblique, each lobe usually with several, blunt, serrate margin, texture subcoriaceous, veins channelled, flabellate. Sori about 0.5 cm long, contiguous, straight, oblique to costae, not raching to margin; indusium up to 0.3 cm wide, pale-green, attached to the veinlet; spores pale, translucent.

Rare in dense, evergreen forests of lower elevations.

Fertile: October.

Distribution: MALAYA, S. AFRICA, BHUTAN, SRI LANKA, INDIA - Nilgiris, Sikkim, Assam and Meghalaya up to 1200 m elevation.

Specimens examined: Jamir 6690 Tejit (Mon dist., 200 m).

Asplenium paradoxum Blume,Enum. 179. 1828; Bedd., Handb. Ferns Brit. India 151. 1883; Holttum, Fl. Malaya 2: 430. 1968.

Rhizome short-creeping, the apex covered with ovate-lanceolate, dark-brown, clathrate hair-tipped scales; scales about 0.2 - 0.7 cm long, Stipes 10 - 20 cm long, firm, erect, green, sparsely clothed with dark-brown, ovate-lanceolate scales; rachis firm, erect, compound, scaly, grooved above; lamina up to 40 x 15 cm, simple pinnate with 6 - 12 pairs of lateral pinnae, alternate or sub-opposite; apical pinnae with a young bud (proliferous) at its base; the lowest pinnae up to 8,5 x 2.5 cm, broadly cuneate on the acroscopic side, narrowly on the basioscopic side at the base, shortly petiolate, apex acute; the margins entire or slightly toothed; texture subcoriaceous; veins obscure, oblique, forked once or twice. Sori about 1.5 cm long, oblique, nearly reaching margin; occupying almost the whole length of the veins; indusium firm, dark-brown; spores dark, opaque, with a clear wing, more or less anastomosing flexuous.

Frequent; in shady slopes of mountains in thick forests.

Fertile: February.

Distribution: PENANG, JAVA, SUMATRA, MALAYA, INDIA - N.E. India.

Specimens examined: Jamir 7966 Changki (Mokokchung dist., 1000 m).

A new distributional record for north-east India.

Asplenium perakense Mathew & C. Chr. in J. Linn. Soc. Bot. 39: 214. 1909.

Rhizome short-creeping, clothed with dark-brown, entire, lanceolate, acuminate scales; scales about 0.6 x 0.1 cm. Stipes 10 - 18 cm long, tufted, dark to greenish, densely linear scaly at base, sparsely above; grooved on the adaxial surface; rachis similar to that of stipes; lamina 20 - 40 x 4 - 8 cm, simple pinnate, narrow, oblong-lanceolate, greenish-brown, shining, glabrous, lateral pinnae 20 - 30 pairs, slightly ascending, the lowest basal pair somewhat reduced, the upper ones rather abruptly reduced, ending in a narrow, deeply lobed apex, alternate to subopposite; the largest pinnae 1.5 - 5 x 1 - 1.5 cm, the upper base auricled, broadly cuneate to truncate, the lower base cut down to the midrib , then narrowly cuneate; basal segment about 1.8 x 1 cm, flabellate, segments again 2 - 3 lobed, sharply toothed at margins, the other lobes oblique to the costae, narrowly oblong, blunt to acute, texture coriaceous, midrib grooved above; veins oblique, forked once or twice. Sori up to 0.8 cm long, oblique or parallel to the midrib; indusia up to 0.6 cm wide, pale-green, firm,

entire (not rolled back at maturity); spores dark, translucent.

Frequent on tree trunks and moss-covered rocks in forests.

Fertile: July - October.

Distribution: MALAYA, CHINA, JAPAN, JEHELUM VALLEY, INDIA - Kashmir.

This is a new record for north-east India.

Specimens examined: Jamir 6076 Peren (Kohima dist., 1445 m); 6383 Mezenkong (Mokokchung dist., 1326 m).

✓Asplenium phyllitides D. Don, Prodr. Fl. Nepal 7. 1825; Holttum, Fl. Malaya 2: 420. (ed. 2). 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 115. 1982. Neotiopteris phyllitides (D. Don) H.Ito in J. Jap. Bot. 14: 733. 1938.

Usually epiphytes, sometimes on rocks. Rhizome short, rather stout, erect to suberect, apex clothed with thin, clathrate, broad-acuminate black to dark-purplish scales; scales about 1 x 0.2 cm or more, margin bearing numerous hair-like appendages. Stipes up to 3 x 0.4 cm, short, rather stout, dark to pale-brown, glabrous except the scaly base;

lamina 30 - 90 x 3 - 4 cm, simple, lanceolate, narrowed gradually at both ends, widest somewhat near middle, glabrous; midrib prominently raised on upper surface, shining, pale-greenish; texture coriaceous, veins nearly parallel, forked once or twice. Sori linear, borne along each veinlet on upper half of the lamina, nearly reaching from midrib to margin; indusia linear, narrow, superficially attached at base just above the veins, opening outwards, spores light-brown, translucent or opaque, the wing irregularly thickened, somewhat anastomosing.

Common throughout the state, usually grows in moist dense forests on tree trunks as well as on humus covered rocks.

Fertile: September - October.

Distribution: S.E. ASIA, MALAYA, JAVA, INDIA - Western ghats; Himalayas, Meghalaya.

Specimens examined: Jamir 6530 Wokha (Wokha dist., 1314 m); 6221, 7221 Changki (Mokokchung dist., 1000 m); 6062 Peren (Kohima dist., 1446 m).

Very similar to Asplenium nitidus excepting for its size; Biosystamtic studies are essential to delimit these species.

Asplenium rockii C. Chr. in Contr. U.S. Nat. Herb. 26: 332. 1931; Baishya & Rao, Ferns & Fern-allies Meghalaya 115. 1982.

Rhizome short-creeping, densely clothed with dark-brown, clathrate, lanceolate -acuminate, hair-tipped scales; scales about 0.5 cm long. Stipes 3 - 10 cm long, erect or suberect, densely covered by narrow-lanceolate, fimbriate, blackish-brown scales; rachis slender, greenish, scaly; lamina 12 - 30 x 3 - 5 cm, bipinnate-lanceolate, acuminate, greenish; pinnae 10 - 20 pairs, alternate, shortly petiolate, basal ones somewhat reduced, largest pinnae up to 2 x C.7 cm, truncate at upper base, cuneate at lower base, margin pinnately cut into 2 - 4 pairs of alternate pinnules or segments, basal pinnule up to 0.5 cm long, cuneate-spathulate, deeply incised, upper margin with 3 - 6 obtuse lobes, the apical pinnules cuneate or linear-oblong with 2 - 3 obtuse lobes; texture subcoriaceous, veins depressed, indistinct, firm, forked once or twice. Sori up to 0.3 cm long, linear, 2 - 3 in each segment, on one side of the veins; indusia about 0.1 cm wide, thin, oblong, attached along the veins, opens towards the midrib, rolled back at maturity, margin undulate or somewhat entire; spores pale brown.

Not common; in shady places in dense forests near streams and on tree trunks.

Fertile: October.

Distribution: SIAM, BURMA, INDIA - Eastern ghats, Assam, Meghalaya.

Specimens examined: Jamir 6584 Wokha (Wokha dist., 1314 m).

Asplenium sarelii Hook. in Blackiston, Yangtsze, 363, 364. 1862; Stewart in Bull. Torrey Bot. Cl. 72, 417. 1945; Dhir, Ferns N.W. Himalayas 110. 1980; Nair & Dixit in J. Bomb. nat. Hist. Soc. 78(3): 446. 1981.

A. pekinense Hence in J. Bot. 5: 262. 1867; Clarke in Trans. Linn. Soc. Lond. Ser. 2 (Bot.) 1: 483. 1880; Bedd., Handb. Ferns Brit. India 156. 1883.

A. saulii Baker in Syn. Fil. 216. 1874; Hope in J. Bomb. nat. Hist. Soc. 13: 661, t. 18 (less dissected form), 1901.

Rhizome short-creeping, more or less densely covered with black to dark-brown, lanceolate, hair-pointed scales; scales up to 0.5 x 0.1 cm, Stipes 4 - 8 cm long, tufted, more or less densely scaly throughout; lamina 15 - 30 x 4 - 6 cm, linear-oblong, bipinnate, acuminate, greenish-brown; pinnae numerous, 20 - 25 pairs, alternate, shortly petiolate, slightly oblique, largest pinnae up to 3.5 x 1.5 cm, deltoid-lanceolate to subtruncate in outline,

deeply cut down almost to midrib into ovate rhomboidal pinnules or segments, pinnatifid at apex; largest pinnule up to 1.2 x 0.5 cm, linear-obovate with 2 - 5, more or less deep lobes; each lobe again bluntly toothed, texture subcoriaceous, rough; rachises more or less densely clothed with scales which are similar to stipe scales; veins free, forked once or twice. Sori up to 0.5 cm long, linear, elongate, often confluent; indusium pale-brown, entire, along the veins; spores bean-shaped to round, pale-brown.

Rare; on humus soil and moss covered rocks in dense forests.

Fertile: July.

Distribution: CHINA, JAPAN, INDIA - N. W. Himalayas between 600 - 2,100 m.

Specimens examined: Jamir 6077 Embqi forests/Peren (Kohima dist., 1446).

Another new distributional record for this region.

Asplenium tenerum Forst., Prodr. 80. 1786; Bedd., Ferns Brit. India 147, t. 74. 1883; Holttum, Fl. Malaya 432. (ed. 2). 1968; DeVol & Kuo, Fl. Taiwan 1: 489. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 116. 1982.

Rhizome short, erect, densely clothed with linear, dark-brown, clathrate, ovate-lanceolate, hair-tipped scales; scales about 0.6 x 0.1 cm, roots dense, wide spreading; stipes 6 - 10 cm long, tufted, greenish, grooved above, densely scaly when young, glabrous or sparsely scaly at maturity; scales similar to that of stipes; bud proliferous; lamina 15 - 30 x 3 - 5 cm, simple pinnate, linear-lanceolate; pinnae of 20 - 25 pairs; the basal pair somewhat reduced, upper ones slightly and then suddenly reduced to pinnatifid apex; the largest pinnae 2.5 x 1 cm, petiolate, upper base truncate and somewhat auricled, margins crenately toothed; bluntly rounded or acute at apex, texture firm, herbaceous, green to pale-green; veins simple, forked once or twice, slightly raised on both surfaces. Sori up to 0.5 cm wide; spores pale-brown with a thickened wing, somewhat anastomosing.

Abundant; on moist, shady tree trunks in evergreen forests. Frequently upon rocks near streams.

Distribution: SRI LANKA, MALAYA, PHILIPPINES, POLYNESIA, TAIWAN, BORNEA, JAVA, SINGAPORE, INDIA - Meghalaya.

Specimens examined: Jamir 7952 Kohima peak (Kohima dist., 1445 m); 6391 Mezenkong (Mokokchung dist., 1326 m).

✓Asplenium tenuifolium D. Don, Prodr. Fl. Nepal 8. 1825; Bedd., Handb. Ferns Brit. India Suppl. 159, t. 78. 1883; DeVol & Kuo, Fl. Taiwan 1: 489 (ed. 2). 1980; Dhir, Ferns N.W. Himalayas 113. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 116. 1982.

Rhizome short, with densely spreading fibrous roots, apex densely cothed with broad-lanceolate, dark-brown scales; scales about 0.6 x 0.1 cm, Stipes 7 - 22 cm long, tufted, slender, greenish, fleshy, glabrous or with a few slender hairs; rachis glabrous, green; lamina 10 - 25 x 5 - 10 cm, oblong-lanceolate, tri-quadripinnatifid, anadromous, texture thinly herbaceous, lateral pinnae 15 - 20 pairs, alternate, the lowest basal pair somewhat largest, the upper ones rather gradually tapering and suddenly reduced to a narrow lobed apex; apex sometimes proliferous; the basal primary pinnae up to 7 x 3 cm, lanceolate, shortly petiolate, about 0.4 cm long; the lower pinnules up to 2.5 x 1 cm, obovate-deltoid, shortly petiolate, cut down to a narrowly winged, spathulate segments; segments entire, cuneate at base, acute at apex, veins

solitary. Sori about 0.2 cm long, elliptic, usually one in each segment, often two; indusia elliptic, attached at base and sides, open inwardly at apex, pale brown to shining green.

Commonly seen along the rivers and streams on hills; sometimes grows upon wet soil covered rocks. The fronds are finely dissected.

Fertile: October - December.

Distribution: SRI LANKA, NEPAL, VIETNAM, CHINA, TAIWAN, BURMA, BHUTAN, INDIA - South India, Nilgiris, Pulneys and Anamalleys; Himalayas up to 2744 m elevation, Meghalaya 1220 - 2744 m elevation.

Specimens examined: Jamir 7932, 6494 Kohima (Kohima dist., 1445 m); 6605 Mon (Mon dist., 898 m).

✓Asplenium unilaterale Lamk., Encycl. 2: 305. 1786; Clarke in Trans. Linn. Soc. Ser. 2 (Bot.) 1: 481. 1880; Bedd., Ferns Brit. India 152. 1883; Holttum, Fl. Malaya 2: 438. 1968; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 195. 1975; DeVol & Kuo, Fl. Taiwan 1: 490. (ed. 2). 1980; Dhir, Ferns N.W. Himalayas 109. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 116. 1982.

A. resectum Smith, Pl. Icon. t. 71. 1791; Bedd., Ferns Brit. India t. 356. 1870.

(Plate 99)

Rhizome up to 0.6 cm across, rather long creeping, dorsiventral, slender, with branched roots, apex of rhizome with small, narrow-lanceolate, thin-brown, entire, hair-tipped scales; scales about 0.3 cm long; rachis similar to stipe or green, polished and opaque, glabrous, deeply grooved above; lamina 20 - 40 x 6 - 18 cm, unipinnate, linear-lanceolate, the lowest pinnae equal to the next above or slightly smaller, usually somewhat reflexed, the upper pinnae abruptly reduced to a narrow, acuminate lobe; pinnae 4 - 7 x 1 - 1.5 cm, 20 - 30 pairs or more, shortly stalked, alternate to subopposite, the upper base broadly cuneate or subtruncate, the lower margin of the lower base close to the midrib, apex tapering to a blunt to shortly acute point, the upper margin and the distal part of the lower margin unevenly blunt serrate, texture thin; veins free, forked once or twice near the costa, distinctly raised on both surfaces. Sori up to 0.5 cm long, usually copious, linear, median, oblique to the costa, dorsal along the forked veinlets; indusia thin, pale-brown, entire; spores dark, winged, anastomosing.

Very common, usually grows on rocks near streams and rivers, and sometimes in shady areas on hills.

Fertile: May - December.

Distribution: AFRICA, MALAYA, CHINA, POLYNESIA, JAPAN, NEPAL, BANGLADESH, SRILANKA, BHUTAN, INDIA - Western ghats

Himalayas up to 1525 m elevation and Meghalaya.

Specimens examined: Jamir 6209 Changki (Mokdchung dist., 1000 m); 7063 Changki (Mokokchung dist., 1000 m); 7946 Kohima (Kohima dist., 1445 m).

Asplenium unilaterale Lamk. var. delicatulum Parish. in Bedd. Handb. Ferns. Brit. India 153. 1883; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim 157. 1964; Dhir, Ferns N/W. Himalayas 109. 1980.

Rhizome up to 0.4 cm across, roots slender, spreading. Stipes 6 - 12 cm long, dark-brown, opaque, naked, eboneous, shining, distant up to 3 cm; lamina 15 - 30 x 3 - 6 cm, lanceolate oblong in outline, pinnate; pinnae numerous, about 15 - 30 pairs, alternate or subopposite, the lowest 1 - 2 pairs somewhat reduced and deflexed; largest pinnae up to 3 x 1 cm, oblong, the upper base broadly truncate or subtruncate, the lower 1/2 or 1/3 of the margin cut away, entire, acute or obtuse at apex, margin shallowly lobed or serrate, not uniform, texture thin, rather transparent, herbaceous, glabrous on both surfaces; rachis quite similar to the stipe; veins free, forked once or twice, rather distinct on both surfaces. Sori up to 0.4 cm long, linear, medial or not, reaching either midrib or margin; indusia thin, pale-brown, entire or slightly

serrulate. Spores dark-brown, perispore broad, transparent reticulately folded.

Rare; in moist shady places near rivers and streamlets in dense forests.

Fertile: December.

Distribution: INDIA - N.W. Himalayas.

Specimens examined: Jamir 7285 Kohima Science College road forests (Kohima dist., 1500 m).

This variety is quite similar to the type but much smaller and the pinnae are different.

31. ATHYRIACEAE

Terrestrials or sometimes epiphytes. Rhizome short, erect or rarely creeping; scales thin, pale-brown to dark-brown, lanceolate or ovate, edges entire or toothed, never clathrate; stipes rather stout, erect or semierect, base flattened, sometimes ridged and bearing papillae or spines; vascular strands 2 at base and uniting into a single 'U'-shaped strand above; lamina pinnate to decompound, rarely simple, usually thin, rachises minutely scaly on the lower rounded face, papillate in the grooved upper face; veins free, forked, rarely anastomosing without included veinlets. Sori dorsal, oblong to linear, single or double, subcircu-

lar or round; indusia flap-like, narrow, attached to the fertile vein, elongated or 'J'-shaped, double or horse shoe-shaped; sporangia globose; annulus of 10 - 20 thickened cells; spores usually with a variously folded, grannulose perine, bilateral; exine smooth or granulose to rugulose.

A large family of 23 genera; 5 in Nagaland.

K E Y T O G E N E R A

1a. Stipe and rachis pubescent.
  2a. Fronds bipinnatifid; sori linear . . 4. Athyriopsis
  2b. Fronds tripinnate to tripinnatifid or 4- or 4-pinnatifid; sori round.
    3a. Stipe covered by multicellular hairs . . . . . 1. Cystopteris
    3b. Stipe not covered by such hairs . 3.Dryoathyrium
1b. Stipes and rachis glabrous or nearly so.
  4a. Double sori not connected at their distal ends (not crossing over the veinlets); basal stipe scales firm, very narrow, linear-lanceolate; dark-brown . . . . . 5. Diplazium
  4b. Double sori connected at their distal ends (sor crossing over the veinlets); basal stipe scales thin, ovate lanceolate, usually pale brown . . . . . 2. Athyrium

1. Cystopteris

Bernh, Schrad. Neu. J. 1: 5, 26. 1806; C. Chr., Ind. Fil. 203. 1906; Copel., Gen. Fil. 146. 1947.

Rhizome short-creeping, clothed with thin, small, lanceolate, brown scales; vascular strand dictyostelic. Stipes remote or approximate, slender, sparsely scaly, and with multicellular hairs, purplish, smooth, with 2- vascular bundles at base, uniting into a 'U'-shaped bundle above; lamina bipinnate to decompound; veins free. Sori small, round, dorsal on veins; indusia oval or ovate, attached on basioscopic side of sorus, arching over the young sorus, opening towards margins.

Species about 18; 1 in Nagaland.

Cystopteris fragilis (Linn.) Bernh. Schrad. Neu. J. Bot. 1: 26. 1806; Hook. & Baker, Syn. Fil. 103. 1874; Bedd., Handb. Ferns Brit. India 70. 1883; Ohwi, Fl. Jap. 77. 1965; Bir et al., in Amer. Fern. J. 66: No. 3. 109. 1976; DeVol & Kuo, Fl. Taiwan 1: 456. (ed. 2). 1980; Polypodium fragile Linn., Sp. Pl. 2: 1091. 1753.

Rhizome short -creeping, clothed with thin, small, ovate-lanceolate, brown scales; stipes about 15 - 40 cm long, scaly at base, glabrous above, glossy, shining,

purplish-brown; lamina 15 - 30 x 5 - 10 cm, ovate-lanceolate, tripinnatifid, glabrous; lowest basal pinnae 10 x 4 cm, delto-lanceolate, alternate, petiolate, largest pinnules up to 4 x 1.5 cm, oblong, rhomboidal, deeply lobed into segments; segments obtuse, margin bluntly or sharply serrate; rachis and costa glabrous, purplish, shining; texture thin, herbaceous; veins free. Sori round, dorsal on veinlets; indusium thin, ovate, attached by broad base.

Common along roadsides at low altitudes.

Fertile: December.

Distribution: AMERICA, EUROPE, ASIA, INDIA - North Western Himalayas from Kashmir to Kumaon.

Specimens examined: Jamir 7937 Rangapar Train road (Kohima dist., 250 m). A new record for N.E. India.

2. Athyrium

Roth., Tent. Fl. Ferm. 3: 31, 58. 1799; Copel., Gen. Fil. 138. 1947.

Terrestrials. Rhizome rather stout, erect, rarely creeping, covered with persistent stipe bases; scales usually thin, ovate-lanceolate, pale-brown to dark-brown, rarely narrow. Stipes stramineous, tufted; lamina bipinnatifid to tripinnate, rarely pinnate; texture thin; veins free, often anastomosing. Sori dorsal, round to elongate, on one

side of veins, simple or double on both sides of veins; indusia brown, linear, 'J'-shaped or reniform; sporangia slender stalked; annulus incomplete, vertical.

A large genus comprising about 180 species; 7 in Nagaland.

K E Y T O S P E C I E S

1a. Sori linear, more or less confluent on either side of vein, oblique . . . latifolium

1b. Sori round or reniform, not confluent.

2a. Fronds large, more than twice pinnate (quadripinnate) indusium conspicuous. . . . . thelypteroides

2b. Fronds small, bipinnate; indusium present or not.

3a. Indusium lacerate; spores smooth . . . . . drepanopterum

3b. Indusium entire; spores tuberculate.

4a. Pinnae deeply divided (bipinnate).

5a. Persistent stipe bases muricate with scale bases, black; pinnae lobes (pinnules) distinctly stalked . . . . . dentigerum

5b. Persistent stipe bases otherwise; pinnae lobes sessile.

6a. Sori large completely covering the pinnules; indusia large, persistent .*atkinsonii*

6b. Sori small, not covering the whole surface; indusia minute, deciduous .*puncticaule*

4b. Pinnae not deeply divided (unipinnate); margin sharply toothed . . *nigripes*

Athyrium atkinsonii Bedd., Ferns Brit. India Suppl. 11. Pl. 359. 1876; et Handb. Ferns Brit. India 163, 1892.

A. monticola Rosenst. in Hedw. 13: 113. 1913.

Asplenium atkinsonii Clarke in Trans. Linn. Soc. Lond. Ser. 2 (Bot.) 1: 487. 1880.

Pseudocystopteris atkinsonii (Bedd.) Ching in Acta Phytotax Sinica 9: 78. 1964; DeVol & Kuo, Fl. Taiwan 1: 474. 1980.

Rhizome erect to semierect. Stipes 6 - 20 cm long, tufted, pale-brown, scaly at base; scales lanceolate, attennuate, brownish; lamina up to 30 x 10 cm, ovate-lanceolate, tripinnate to quadripinnatifid; lateral pinnae up to 6 - 10 pairs, the lowest pair somewhat largest; pinnae, pinnules and segments petiolate or sessile; segments more or less crenate; texture thin, herbaceous; glabrous above, with small, clavate or linear, glandular hairs beneath; veins free, forked. Sori round, brown; indusia oval or reniform.

Fertile: August.

Distribution: CHINA, TAI A., JAPAN, INDIA - Himalayas region.

Specimens examined: N.L.Bor 16064 Kohima at 2,000 m (ASSAM).

We have not been able to locate this plant anywhere from Nagaland.

Athyrium dentigerum (Clarke) Mehra & Bir, Amer. Fern. J. 50: 270. 1906; Dhir, Ferns N.W. Himalayas 89.1980.
Asplenium filix-foemina var. dentigera Clarke in Trans. Linn. Soc. Lond. Ser. 2, (Bot.) 1: 491. 1880.
Athyrium filix-foemina var. dentigera Bedd., Handb. Ferns Brit. India 169. 1883.

Rhizome short-creeping, densely covered with linear-lanceolate, dark-brown, hair-tipped scales; scales up to 1 x 0.2 cm; roots wide-spreading, blackish. Stipes up to 40 cm long, pale greenish when dry, smooth, scaly at base, glabrous above; lamina up to 50 x 20 cm, ovate to oblanceolate in outline, bipinnate to tripinnatifid; lateral pinnae numerous, up to 12 pairs, subopposite to alternate, the lower pairs somewhat reduced, largest pinnae 12 x 5 cm, deltoid to ovate-oblong, petiolate; secondary pinnae numerous, up to 15 pairs, alternate, shortly petiolate or sessile; largest up to 2.5 x 1.2 cm, oblong, slightly

oblique at base, rounded, deeply cut down to midrib into segments or lobes; lobes up to 0.6 x 0.3 cm, oblong, sessile or decurrent at base, margin again more or less deeply crenate or sometimes rather sharply toothed; rachises succulent, grooved when dry, both rachises and costae pale-green, smooth, shining; texture thin, sub-coriaceous, both surfaces of lamina glabrous, except for spine-like, soft, whitish hairs on the upper surface of lamina near the midrib; veins free, forked once or twice, sometimes more. Sori up to 0.2 cm long, short, oblong, slightly oblique, closer to midrib; indusia thin, transparent, subquadrate.

Rare; in dense, shady forest floor in higher altitudes.

Fertile: December.

Distribution: NEPAL, BHUTAN, INDIA - Himalayan region, up to 1800 - 3300 m.

Specimens examined: Jamir 7234 Kohima (Kohima dist., 2,300 m); 7241 Japvo hills (Kohima dist., 2,400 m). A new record for N.E. India.

Athyrium drepandpterum (Kuntze) A. Brown in Milde Fil. Eur. 49. 1867; Iwatsuki in Hara Fl. East. Himal. (3 Rep.) 182. 1975; DeVol & Kuo, Fl. Taiwan 1: 448. 1980; Dhir, Ferns N.W. Himalayas 91. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 138. 1982.

Polypodium drepanopterum Kuntze in Linnaea 23: 318. 1850.

Athyrium oxyphyllum Moore, Ind. Fil. 40. 1857; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 493. 1880.

Rhizome 2 - 3.5 cm across, erect or semierect, densely covered with narrowly linear, lanceolate, entire, reddish-brown, hair-tipped scales; scales about 2 x 0.2 cm. Stipes 3 - 30 cm long, variable in length, tufted, scaly at base, and more or less glabrous above; lamina up to 45 x 20 cm, broadly oblanceolate, bipinnate to tripinnatifid, glabrous, somewhat shining, striate when dry, anadromous, adaxial pinnules larger than the abaxial ones; primary pinnae up to 20 x 10 cm, linear-lanceolate, stalked (stalks up to 0.5 cm long) ascending, often falcate, deeply pinnatifid; largest pinnule up to 4 x 1.5 cm, sessile or subsessile, deeply lobed; basal lobes of the pinnule more or less hastate or auricled; lobes dentate or sharply serrate, particularly at apex, often subentire; rachis and costae glabrous; texture subcoriaceous; veins free, forked. Sori

reniform, medial on veinlets; indusia broadly reniform, small, fugaceous or wanting; sporangia slender stalked, spores elliptic-oval, brownish, hyaline; exine smooth.

Very common, along road cuttings in open as well as shady places.

Fertile: October - December.

Distribution: BURMA, CHINA, PHILIPPINES, TAIWAN, BHUTAN, INDIA & Himalayas up to 1220 - 3353 m elevation and Meghalaya.

Specimens examined: Jamir 7910, 6460 Kohima (Kohima dist., 1445 m); 6420, 6423 Tejit (Mon dist., 200 m); 6315, 6311 Shamator (Tuensang dist., 1692 m).

✓ Athyrium latifolium D. Don, Prodr. Fl. Nepal 8. 1825; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 502. 1880; Baisya & Rao, Ferns & Fern-allies Meghalaya 138. 1982.

A. dilatatum Hook., Sp. Fil. 3: 258. 1860.

Diplazium dilatatum Blume, Enum. Pl. Jav. Fil. 194. 1828; Bedd., Ferns South India t. 192. 1863; DeVol & Kuo, Fl. Taiwan 1: 463. Pl. 165. 1980.

D. latifolium Bedd., Handb. Ferns Brit. India 187. 1883; Dhir, Ferns N.W. Himalayas 95. 1980.

Large terrestrial ferns. Rhizome erect to ascending, rather stout, apex covered with linear, oblanceolate, thin, pale-brown scales; scales about 1.5 x 0.3 cm; margin black, distantly toothed. Stipes 30 - 60 cm long or more, erect, solid, slender, deeply grooved, scaly at base, glabrous or rough above with bases of fallen scales; lamina 40 - 70 cm long or more, broad, bipinnate to tripinnatifid; largest pinnae 25 - 50 x 8 - 20 cm, deltoid-lanceolate; largest pinnule 10 x 3 cm, shortly stalked, base truncate-cordate, gradually tapering, apex acuminate, more or less cut down to the costa; segments about 1 cm wide at base, slightly oblique, apex rounded, margin usually finely crenate or serrate; smaller pinnules sessile, less deeply lobed; rachis and costules greenish, glabrous; texture thin but firm; veins free, forked; Sori up to 0.5 cm long, linear, confluent along both sides of the veins, slightly oblique to the costule; indusium about 0.4 cm long, linear, pale-green, margin crisped; sporangia slender stalked, small; spores oval; pale-brown, hyaline; exine smooth.

Common in moist and shady places in forests.

Fertile: Febaruary - December.

Distribution: CHINA, INDONESIA, MALAYA, TAIWAN, AUSTRALIA, PHILIPPINES, SRI LANKA, INDIA - South India, Western forests; North India, throughout the Himalayas, Meghalaya.

Specimens examined: Jamir 6156 Phek (Phek dist.,1200); 7070 Changki (Mokokchung dist., 1000 m); 7901 Kohima (Kohima dist., 1445 m).

Athyrium nigripes (Blume) Moore, Ind. Fil. xlix, 1857, 98, 1858; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 182. 1975; Dhir, Ferns N. W. Himalayas 86. 1980.
Aspidium nigripes Blume, Enum. Pl. Jav. 11: 162. 1828.
Athyrium solenopteris Bedd., Handb. Ferns Brit. India 166. 1883 (pro parte) non Moore.
Asplenium nigripes Hope in J. Bomb. nat. Hist. Soc. 14: 119. 1902.

Rhizome short-creeping, stout, densely covered with thin, brown, hair-tipped, lanceolate scales; scales up to 1.3 x 0.2 cm . Stipes 5 - 15 cm long, tufted, firm, pale, glabrous; lamina 10 - 30 x 5 - 10 cm, bipinnate, delto-lanceolate, glabrous; pinnae 15 - 25 pairs, alternate, sessile or shortly stalked, the lowest pair somewhat reduced to the next; largest pinnae 5 x 1.5 cm, oblanceo-late; the lowest basal pinnule somewhat larger; pinnules close, often deeply pinnatifid or reduced to a winged rachis, segments serrate or toothed, texture thin, herbaceous; rachis glabrous; veins free, forked. Sori round or linear-oblong; indusia brown, persistent; spores pale, translucent.

Rare but common only around Kohima.

Fertile: December.

Distribution: MALAYA, BHUTAN, INDIA - Himalayas from Kashmir to Darjeeling; Meghalaya.

Specimens examined: Jamir 7910, 6460 Kohima (Kohima dist., 1445 m).

✓Athyrium puncticaule (Blume) Moore, Ind. Fil. 186. 1860; Dhir, Ferns N.W. Himalayas 88. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 138. 1982.
Aspidium puncticaule Blume, Enum. Pl. Jav. 151.1828.
Athyrium macrocarpum (Blume) Bedd., Ferns South India t. 152, 153. 1863; et Handb. Ferns Brit. India 165. 1883; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 488. 1880; Holttum, Fl. Malaya 2: 550. 1968.

Rhizome short, erect or semierect, apex clothed with thin, entire, light-brown, broad-lanceolate scales; scales about 1 x 0.2 cm. Stipes 10 - 25 cm long, tufted, firm, slender, grooved, sparsely scaly; lamina 20 - 35 x 7 - 15 cm, or more, oblanceolate, bipinnate at base, apex pinnatifid; pinnae 15 - 25 pairs, stalked, alternate, the lowest somewhat reduced, auriculate at the base on the acroscopic side; largest pinnae 3 x 1 cm, auricled at base; lobed, rather deeply cut down to the costa, the lobes slightly oblique, round, entire or somewhat serrate; the apex of

the pinnae blunt, margin slightly toothed; rachises and costae beneath bearing a few scales and sparse, short, hyaline hairs; texture herbaceous, pale-green. Sori medial on the vein, reniform; indusia thin, reniform, membranous, margin lacerate, sporangia shortly stalked, pale-brown; annulus not prominent; spores pale, oval, yellowish-green; exine tuberculate.

Abundant both in open as well as shady places in forests.

Fertile: July - October.

Distribution: CHINA, TAIWAN, PHILIPPINES, MALAYA, THAILAND, BURMA, SRI LANKA, BHUTAN, INDIA - South India, western ghats, Himalayas, Garwhal from 600 - 2744 m elevation, Meghalaya.

Specimens examined: Jamir 6414 Tejit (Mon dist.,200 m); 7085 Kohima (Kohima dist., 1445 m).

Thyrium thelypteriodes (Mich.) Desv., Prodr. 226. 1827; Bedd., Handb. Ferns Brit. India 164. 1883; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim 144. 1964; Dhir, Ferns N.W. Himalayas 91. 1980.
Asplenium thelypteroides Mich. Fl. Bor. Am. 2: 265. 1803; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.). 1: 488. 1880.

Athyrium acrostichoides (Sw.) Diels, Engl. & Prantl, Nat. Pfl. 14: 223. 1899; C. Chr., Ind. Fil. 139. 1905.

Rhizome up to 1 cm thick, short-creeping, stout, with spreading roots; stipes up to 80 cm long, stout, erect to semierect, pale-brown to greenish, covered with thin, lanceolate scales at base, stramineous above; lamina up to 75 x 60 cm, wide spreading, deltoid, tripinnate; the lowest lateral primary pinnae largest, about 60 x 30 cm, petiolate; bipinnate to tripinnatifid; secondary pinnae up to 10 pairs, alternate, the lowest largest, about 20 x 10 cm, deltoid-oblong in outline, petiolate; tertiary pinnae or pinnules about 10 pairs, alternate, sessile or shortly stalked, the lowest basal one largest, about 7 x 2 cm, deltoid to oblong-lanceolate, very shortly stalked, deeply cut down to almost to costae into segments or lobes; largest lobe 1 x 0.5 cm, oblong, decurrent at base, obtuse or rounded at apex, margin bluntly crenate, rachis and costa greenish-brown when dry, glabrous or stramineous; texture thin, herbaceous, both surfaces of lamina glabrous, greenish-brown when dry; veins free, forked on each lobe up to margin. Sori small, short-oblong, dark-brown, slightly oblique to costae, close, arranged in 2 rows; indusia thin, transparent, covering the whole sori when young.

Rare, in dense natural forests on hills.

Fertile: January.

Distribution: NORTH AMERICA, CANADA, BHUTAN, INDIA - N. W. Himalayas, N.E. India.

Specimens examined: Jamir 7286 Kohima peak/Polypotse (Kohima dist., 1600 m).

3. Dryoathyrium

Ching in Bull. Fan. Mem. Inst. Biol. Bot. 11: 79.1941.

Terrestrials. Rhizome rather short, ascending to erect, with or without scales. Stipes long, scaly with 2 vascular strands at base uniting into a U-shaped bundle above. Fronds broadly ovate, bipinnatifid to tripinnatifid, texture herbaceous, bearing multicellular hairs on dorsal side of rachis and rachillae; veins free, simple or forked. Sori round, dorsal on veins; indusia round, reniform, or cordate, entire, sometimes exindusiate.

A small genus of 7 species; 1 in Nagaland.

Dryoathyrium boryanum (Willd.) Ching in Bull. Fan. Inst.Biol. Bot. 11: 81. 1941; DeVol & Kuo, Fl. Taiwan 1: 470. (ed.2) 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 140. 1982.

Aspidium boryanum Willd., Sp. Fil. 5: 285. 1810.

Athyrium boryanum (Willd.) Tagawa in Acta Phytotax. Geobot. 4: 144. 1935; Holttum, Fl. Malaya 2: 567. 1968.

(Plate 101)

Rhizome short, erect to ascending, apex densely clothed with lanceolate, dark-brown scales; scales about 1.5 x 0.1 cm, surfaces bearing long, slender septate hairs. Stipes 50 - 100 x 0.5 - 1.5 cm, tufted, rather stout, green, pale-brown when dry, scaly at base, lamina variable in size up to 100 cm long, or even more, broadly ovate, deeply tripinnatifid; pinnae numerous, alternate, petiolate or subsessile, the lowest somewhat reduced to the next; largest pinnae up to 50 x 20 cm, broad-lanceolate, petiolate, pinnules alternate, well spaced, deeply pinnatifid; largest pinnule 12 x 3 cm, lanceolate, sessile or subsessile, distant, apex acuminate, margin deeply cut down almost to the costa into oblong segments; largest segments up to 1.5 x 0.5 cm, margin obliquely serrate, the lowest basal segments somewhat reduced; texture thin, softly herbaceous; rachis, costa and costules stramineous, dorsal side densly multicellular hairy, veins free, forked. Sori round, medial, indusium thin, small, roundish or reniform,

brown, margin finely lobed or serrate, fugaceous; spores dark, exine papillate.

Extremely common throughout the state, usually grows in moist, shady places near rivers and streams.

Fertile: July - February.

Distribution: MALAYA, VIETNAM, S. CHINA, TAIWAN, PHILIPPINES, INDIA - South India, Himalayas, Meghalaya.

Specimens examined: Jamir 6499, 6086, 6083 Kohima (Kohima dist., 1445 m); 6138 Phek (Phek dist., 1200 m); 7993, 6195 Changki (Mokokchung dist., 1000 m); 6393 Mezenkong (Mokokchung dist., 1326 m); 6443, 6429 Zenheboto (Zenheboto dist., 2043 m); 6654 Mon (Mon dist., 898 m); 6527 Wokha (Wokha dist., 1314 m); 6253 Mepongchuket (Mokokchung dist., 1300 m); 7993, 7051 Changki (Mokokchung dist., 1000 m); 6336 Shamator (Tuensang dist., 2136 m).

4. Athyriopsis

Ching, Acta phytotax. Sin. 9:63.1964.

Rhizome creeping; scales thin, chaffy brown, lanceolate, Stipes distant; stipes and rachis stramineous with multicellular hairs on the dorsal side and with scattered, narrowly lanceolate, yellowish-brown scales on the ventral surface; lamina pinnate to bipinnatifid, apex pinnatifid; pinnae patent, subsessile, acuminate; veins free, forked.

Sori linear, single or double; indusia firm, margin erose.

A genus with about 15 species; 1 in Nagaland.

✓Athyriopsis japonica (Thunb.) Ching in Acta Phytotax. Sinica 9: 65. 1964; DeVol & Kuo, Fl. Taiwan 1: 444. 1980.

Asplenium japonicum Thunb., Fl. Jap. 334. 1784.

Diplazium japonicum (Thunb.) Bedd., Ferns Brit. India Suppl. 12. 1876.

Athyrium japonicum (Thunb.) Copel. in Philip. J. Sci. 3: 290. 1908; Ohwi, Fl. Jap. 83. 1965; Dhir, Ferns N.W. Himalayas 91. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 138. 1982.

Rhizome creeping or suberect, apex covered with broad, thin, dark-brown, linear-lanceolate scales; scales about 1 x 0.2 cm; roots fibrous. Stipes 10 - 30 cm long, slender, erect, scaly at base, pubescent or glabrous above; lamina 15 - 40 x 10 - 20 cm, bipinnatifid, deltoid to lanceolate; pinnae 5 - 15 pairs, alternate to opposite, sessile or petiolate, lanceolate, often falcate; largest pinnae up to 15 x 5 cm, deeply cut down almost to the costa; lobes up to 2.5 x 0.6 cm, oblong-rounded, subentire or with few teeth at apex; texture thinly coriaceous; rachis and costa with crisped hairs, intermixed with small, short scales or sometimes glabrous; veins free, forked, often hairy or

crisped scaly. Sori up to 0.4 cm long, linear, single or double, 3 - 10 pairs in each lobe; slightly oblique to the costule, continuous from costule to nearly reaching the margin; indusia linear, brownish; margin erose; spores globose to oval, dark; exine spinulose.

Common in moist, shady places in forests and along roadsides.

Fertile: July - February.

Distribution: KOREA, JAPAN, SRI LANKA, NEPAL, TAIWAN, CHINA, MALAYA, INDIA - Western ghats, N.W. Himalayas, Meghalaya.

Specimens examined: Jamir 6128 Kohima (Kohima dist., 1445 m); 6247 Mepongchuket (Mokokchung dist., 1326 m); 6136 Phek (Phek dist., 1200 m); 7998, 6216, 7115 Changki (Mokokchung dist., 1000 m); 6682, 6683 Tejit (Mon dist., 800 m).

5. Diplazium

Sw., Schrad. J. Bot. 1800, 2: 61. 1801; C. Chr., Ind. Fil. 227. 1906; Copel.,Gen. Fil. 147. 1947.

Terrestrials. Rhizome creeping, ascending or erect; more or less densely covered with black to brownish, linear-lanceolate, not clatthrate scales. Stipes with 2 vascular

bundles at base, uniting in upper stipe to form a single 'U'-shaped bundle, more densely scaly at base, sparsely above. Lamina rarely simple, usually pinnate or bipinnate, some species tripinnatifid to tripinnate; texture firm, herbaceous to subcoriaceous, usually glabrous on both suffaces; veins free, forked. Sori linear, basal or medial along side of veinlets, oblique to the costae, usually single, sometimes double, nearly always doubled on the basal veinlets of a pinnule; indusia linear, never meeting at their distal ends, but dorsally on the veins meet back to back, not reniform or 'J'-shaped, entire or crenate; spores bilateral.

A very large genus of 350 species or more; 11 in Nagaland.

K E Y T O S P E C I E S

1a. Fronds simple or pinnate.

2a. Fronds simple . . . . . subsinuatum

2b. Fronds unipinnate.

3a. Pinnae entire . . . . . bentamense

3b. Pinnae shallowly to deeply lobed. . . . . maximum.

1b. Fronds more than once pinnate.

4a. Scales toothed.

5a. Veins anastomosing . . . . . esculentum

5b. Veins free.

6a. Pinnules not deeply lobed, often toothed only . . . . . polypodioides

6b. Pinnules deeply lobed.

7a. Stipes muricate.

8a. Scales on stipe and rachis very narrow, hair-like, abundant; pinnule segments broad, rounded and dentate at apex only . . muricatum

8b. Scales on stipe and rachis broad, sparse; pinnule segments narrow and dentate all around . . procerum

7b. Stipes not muricate.

9a. Fronds quadripinnate, lamina thin membranous; stipe without scales. . spectabilis

9b. Fronds tripinnate; lamina thick, not membranous; stipe densely scaly or without scales.

10a. Stipes and rachis scaly, (densely at base) black; pinnules deeply lobed . . . . . asperum

10b. Stipe and rachis almost without scales, brownish, pinnules shallowly lobed . . polypodioides

4b. Scales entire.

11a. Pinnae 15 - 25 cm long . . bellum

11b. Pinnae 4 - 8 cm long . . . squamigerum

Diplazium asperum Blume, Enum. Pl. Jav. 195. 1828; Bedd., Handb. Ferns Brit. India 184, t. 89. 1883; Dhir, Ferns N.W. Himalayas 96. 1980.

Athyrium asperum (Blume) Milde, Bot. Zeit. 353. 1870. Holttum, Fl. Malaya 2: 257. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 137. 1982.

A. blumei Copel. in Philip. J. Sci. 3C: 294. 1908.

Rhizome short, erect, stout, sometimes subarborescent, scaly at apex. Stipes 50 - 80 x 0.5 - 1.5 cm, rather stout, green, fleshy, glabrous above, densely clothed with nanrow lanceolate, dark-brown scales at base; scales about 2 x 0.3 cm; lamina 60 - 90 x 30 - 60 cm, bipinnate, deeply tripinnatifid, broad ovate-lanceolate, acuminate, largest pinnae 35 x 15 cm, stalked (stalk about 2.5 cm long), oblanceolate, with 20 - 30 pairs of pinnules; largest pinnules up to 8 x 2 cm, sometimes less or more, sessile or subsessile, base truncate or broadly cuneate, apex acuminate, deeply cut down into lobes, nearly reaching the costa; lobes up to 0.5 cm wide, slightly oblique, bluntly pointed, margin toothed throughout; rachis finely pubescent (often costae with narrow scales) texture thin to firm; veins 5 - 12 pairs in each lobe, usually simple, forked. Sori dorsal on the veins, globose; indusia thin, persistent; spores round to reniform; exine bullate.

Common in moist, shady places along river and stream courses.

Fertile: July - December.

Distribution: MALAYA, JAVA, INDIA,- South India, western ghats, and Sikkim.

Specimens examined: Jamir 6481, 6094, 6097 Kohima (Kohima dist., 1445 m); 6442 Zenheboto (Zenheboto dist., 1875 m); 7069 Changki (Mokokchung dist., 1000 m); 6528 Wokha (Wokha dist., 1314 m); 6393 Mezenkong (Mokokchung dist., 1326 m); 6334 Morong forests (Tuensang 2136 m).

✓ Diplazium bentamense Blume, Enum. Pl. Jav. 191. 1828; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 497. 1880; Bedd., Handb. Ferns Brit. India 177, t. 88. 1883;

Athyrium bentamense (Blume) Milde Bot. Zeit. 353. 1870; Holttum, Fl. Malaya 2: 558. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 138. 1982.

(Plate 102)

Rhizome short, suberect, often forming large caudex; roots blackish, wide spreading, naked, wiry. Stipes 30 - 60 cm long, glabrescent, dark-brown, clothed at the base with linear, dark-brown, scales; scales about 1 x 0.2 cm, broad at base, edges finely toothed; lamina 30 - 65 x 15 - 25 cm, simple pinnate; pinnae 2 - 7 pairs, usually alternate, or subopposite, glabrous with a single terminal pinna; the lowest basal pinnae somewhat reduced; largest pinnae

up to 15 - 25 x 3 - 6 cm, lanceolate, petiolate, base slightly unequal on the lower side, rounded or slightly oblique on the upper side, somewhat cuneate and decurrent, slightly falcate, bases of the upper ones more or less equally rounded, gradually narrowed to the acuminate apex or sometimes caudate, margin entire; rachis brownish, glabrous, texture coriaceous, glabrous, greenish; veins free, forked near or at the costa, usually distinct on both surfaces. Sori linear, confluent along the veins; continuous from costa nearly reaching the margins or only to half way, slightly oblique; indusia linear, margin crisped, persistent; spores brownish, hyaline.

Abundant; grows on moist, shady forest floor specially near rivers and streams.

Fertile: July - February.

Distribution: MALAYA, CHINA, INDIA - South India, Meghalaya and Assam.

Specimens examined: Jamir 7064, 7006, 6174 Changki (Mokokchung dist., 1000 m): 6627 Mon (Mon dist., 898 m).

Diplazium bellum (Clarke) Bir in J. Ind. Bot. Soc. 43: 571. 1964.

Asplenium bellum Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 496. Pl. 63. t. 2. 1880; Bedd., Handb. Ferns Brit. India 189. 1883.

Athyrium australe Bedd., Ferns South India t. 158. 1863.

Rhizome short-creeping, dark, roots blackish, wide spreading; stipes 20 - 30 cm or more long, erect, clothed with dark-brown, lanceolate scales at base; muricate above or glabrous; scales about 1 x 0.1 cm; lamina 35 - 60 x 20 - 30 cm, tripinnatifid; pinnae 10 - 15 pairs, petiolate or subsessile, alternate, primary pinnae 30 x 15 cm, ovate-lanceolate, slightly oblique to the rachis, petiolate; secondary pinnae or pinnules up to 10 x 2.5 cm, oblanceolate, acuminate, subsessile or decurrent to the costa margin, deeply cut down more or less up to the costule into segments, ultimate segments up to 0.5 cm broad, slightly oblique, margin usually entire, often shallowly serrate or crenate, oblong, obtuse, texture rather flaccid; rachis and costule dark-brown, stramineous, otherwise glabrous; veins simple, forked, dark-brown, distinct on both surfaces. Sori up to 0.3 cm long, linear, oblique to costule, nearly reaching the margin; indusia about 0.2 cm wide, linear, brown, medial, continuous on one side of veinlets, attached

at a broad base, margin entire; sporangia shortly stalked, dark brown.

Not common; collected only once from a moist, dense forest.

Fertile: July - August.

Distribution: BHUTAN, BURMA, AUSTRALIA, TROPICAL AFRICA, INDIA - South India, Nilgiris and other mountain forests, Sikkim and Meghalaya.

Specimens examined: Jamir 6211 Changki (Mokokchung dist., 1000 m).

✓Diplazium esculentum (Retz.) Sw. in Schrad. J. Bot. 1801: 312. 1803; Bedd., Handb. Ferns Brit. India 192. 1883; Copel., Gen. Fil. 149. 1947; Dhir, Ferns N.W. Himalayas 95. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 140. 1982.

Hemionitis esculenta Retz., Obs. Bot. 4: 38. 1791.

Anisogonium esculentum (Retz.) Presl., Tent. Pterid. 116. 1836; Bedd., Handb. Ferns Brit. India Suppl. 192, t. 94. 1892.

Athyrium esculentum (Retz.) Copel. in Philip. J. Sci. 3C: 295. 1907; Holttum, Fl. Malaya 2: 562. 1968.

(Plate 103).

Rhizome erect, subarborescent, dark-brown, apex densely covered with broad lanceolate, dark-brown scales; scales about 1 x 0.1 cm, margin finely toothed; roots dark, fibrous. Stipes 30 - 60 x 0.5 - 5 cm, rather stout, erect, tufted, sparsely scaly at base, glabrescent or glabrous above; lamina up to 100 x 50 cm or more, wide spreading, bipinnate, sometimes simple pinnate; largest pinnae about 20 - 50 x 10 - 25 cm, petiolate, bearing numerous pinnules; pinnules 6 - 15 x 1.5 - 3 cm, varying in size and lobation, the lowest one shortly stalked, the rest sessile, truncate or broadly cuneate and usually auricled either on one or both sides at the base, apex acuminate, margin more or less deeply lobed; the lobes blunt, margin slightly serrate; texture thin, subcoriaceous; rachis and costa glabrescent or pubescent beneath with numerous pale-brown hairs, and with ovate, toothed scales veins fine, forked, copiously branched with a distinct costule. Sori up to 0.8 cm long, linear, continuous along almost whole length of the veins, on both sides of the veins; indusia linear, margin entire, attached back to back, distal margin free; sporangia shortly stalked; spores oval, dark, hyaline; exine papillate.

Common in moist, shady places; sometimes along rivers and streams in forests.

Fertile: July - February.

Distribution: MALAYA, CHINA, FORMOSA, BANGLADESH, INDIA - South India, western ghats, W. Bengal, Meghalaya.

Specimens examined: Jamir 6242 Mepongchuket (Mokokchung dist., 1200 m); 6000 Changki (Mokokchung dist., 1000 m); 7220 Dimapur (Kohima dist., 250 m).

Diplazium maximum (D. Don) C. Chr., Ind. Fil. 235. 1905; Mehra & Bir in Res. Bull. Punjab Univ. (N.S.) 15: 147. 1964; Dhir, Ferns N.W. Himalayas 95. 1980.

Asplenium maximum D. Don, Prodr. Fl. Nepal 8. 1825.

Athyrium dilatatum (Blume) Milde, Bot. Zeit. 533. 1870; Holttum, Fl. Malaya 2: 574, t. 341. 1968.

Diplazium dilatatum Blume, Enum. Pl. Jav. 194. 1828.

Rhizome short, large, erect, stout, apex densely covered with black to dark-brown, linear-lanceolate, toothed, hair-pointed scales; scales about 1 x 0.1 cm, roots blackish, hard, wiry, wide-spreading. Stipes up to 60 x 0.8 cm or more, scaly at base, usually glabrous or very sparsely above; lamina 75 x 45 cm or more, widely spreading, pinnate or pinnatifid, lateral pinna up to 15 pairs, alternate, petiolate; largest primary pinnae up to 45 x

15 cm, delto-lanceolate in outline, deeply cut down up to costae into secondary pinnae or pinnules, largest pinnule 12 x 2.5 cm, shortly stalked, subcordate to truncate at base, gradually tapering into an acuminate apex, margin more or less deeply cut down towards costae into segments or lobes; largest segment about 1 cm wide at base, slightly oblique, apex rounded, margin rather shallowly toothed or crenate, texture thin but firm, dark-greenish when dry, rachises and costae sparsely clothed with narrow, brown scales; veins distinct, pinnate in each lobe with 5 - 10 pairs of veinlets, lowest acroscopic veinlets often simple, the rest usually forked, reaching the margin. Sori up to 1 cm long, linear, brown, oblique to midrib, stout from the base along 1/2 - 1/3 length of the veinlets, usually single except on the acroscopic basal veinlets; indusia linear, thin, brownish.

Very common in damp and shady places in forests. One of the highly variable species with regard to frond size and shape.

Fertile: October - February.

Distribution: CHINA, INDONESIA, MALAYA, TAIWAN, INDIA- Throughout Himalayan region.

Specimens examined: Jamir 6536,6513 Wokha (Wokha dist., 1314 m); 6664,6665 Tejit (Mon dist.,200 m); 7010,7012,7046 Changki (Mokokchung dist., 1000 m).

Diplazium muricatum (Mett.) vA vR., Malayan Ferns 829. 1909 (non Copel.); Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim Himalayas 148. 1964; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 186. 1975.

Asplenium muricatum Mett. in Ann. Mus. Bot. 2: 239. 1866.

Asplenium procerum Wall. ex Clarke in Trans. Linn. Soc. Lond. Ser. 2, (Bot.) 1: 495. 1880.

Diplazium umbrosum var. procerum Bedd., Handb. Ferns Brit. India 189. 1883 and var. australe pro parte.

Rhizome up to 1.5 cm across, short-creeping, stout, with blackish, spreading roots. Stipes up to 30 cm long, erect to semierect, muricate, scales linear, hair-tipped, dark-brown to blackish throughout; lamina up to 50 x 30 cm, or more, obovate in outline, bipinnate to tripinnatifid; lateral pinnae up to 6 pairs, subopposite to alternate, petiolate, the lowest pair somewhat largest (primary pinnae) up to 30 x 15 cm, ovate lanceolate to delto-lanceolate, petiolate; secondary pinnae about 12 pairs, shortly stalked or sessile or decurrent; largest about 8 x 3 cm, ovate to oblong-lanceolate, subcordate to ovate at base, gradually tapering into a narrowed lanceolate apex, margin deeply cut down almost quite to the costule or midrib into segments or lobes; largest lobe about 1.5 x

0.8 cm, oblong, slightly oblique, margin rather sharply crenate or toothed, texture subcoriaceous; rachises and costae clothed with scales; veins pinnate; veinlets single or once forked. Sori up to 0.3 cm long, short, oblong, brown, slightly oblique to parallel and closer to midrib; indusium up to 0.2 cm long, thin, pale-brown, attached to vein, open outwards.

Rather rare, on moist humus floor in dense forests.

Fertile: October.

Distribution: INDIA - Himalayan region.

Specimens examined: Jamir 6519 Wokha forests (Wokha dist., 1314 m).

Diplazium polypodioides Blume, Enum. Pl. Jav. 194. 1828; Bedd., Handb. Ferns Brit. India 184. t. 89. 1883; (excl. var.); Bir & Shukla in Bull. Bot. Surv. India 8: 271. 1966; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 186. 1975; Dhir, Ferns N.W. Himalayas 94. 1980.

Asplenium polypodioides Mett., Fil. Lips. 78.1856; Clarke in Trans. Linn. Soc. Lond. Ser. 2, (Bot.) 1: 501. 1880.

Rhizome erect, stout, densely covered with dark-brown, fibrillose linear-lanceolate, hair-tipped scales; scales about 1.5 cm long. Stipes up to 70 cm or sometimes more long, tufted, stout, scaly at base, sparsely scaly above or glabrous; lamina up to 80 x 40 cm or more, bipinnate to deeply tripinnatifid; lateral primary pinnae up to 5 - 9 pairs, alternate, the lower ones usually distant, largest lateral pinnae up to 30 x 15 cm or more, oblong-lanceolate, stalked, secondary pinnae up to 9 x 4 cm, subcordate to deltoid-oblong, shortly stalked or sessile, gradually narrowed into a caudate apex, margin deeply cut down almost reaching to midrib, sometimes only up to 1/3 - 1/2 way; segments up to 2 x 1 cm, oblong, margin sharply toothed or serrate, texture thin but firm, herbaceous; rachises and costae usually glabrescent, sometimes sparsely clothed with short scales; lamina glabrous on both surfaces; veins pinnate, veinlets about 6, simple or forked. Sori up to 0.5 cm long, linear, oblique, arranged in two rows in each segment; indusia about 0.4 cm long, thin, brown, linear, oblique, runs along the veins, more closer to midrib than to margin.

Robust ferns, very common in shady and damp places in forsts specially along water courses.

Fertile: July - January.

Distribution: AUSTRALIA, SRI LANKA, MALAYA, INDIA: throughout the Himalayan region, Meghalaya.

Specimens examined: Jamir 7146, 7291 Kohima (Kohima dist., 1500 m); 6660 Mon (Mon dist., 898 m); 6344 Shamator (Tuensang dist., 1200 m); 6452 Zenheboto (Zenheboto dist., 1874 m); 6155 Phek (Phek dist., 1200 m).

Diplazium procerum (Wall.) Nayer & Kaur in comp. Bedd., Handb. Ferns Brit. India 45. 1974.
Diplazium umbrosum var. procerum Wall. Cat. 2203. Bedd., Handb. Ferns Brit. India 189. 1883;
Allantodea procera (Wall.) Ching in Acta Phytotax. Sin. 9: 49. 1964; Nair Comp. Bedd., Handb. Ferns Brit. India 45. 1974.

Rhizome short-creeping, apex covered with lanceolate, dark-brown scales; scales about 0.7 cm long. Stipes 20 - 30 cm long, tufted, erect, rather stout, pale-brown, scaly; lamina 30 - 70 x 20 - 30 cm, broadly ovate-lanceolate, bipinnate to tripinnatifid; pinnae 10 - 15 pairs, alternate, petiolate; largest pinnae or primary pinnae 35 x 18 cm, delto-lanceolate, stalked; pinnules or secondary pinnae up to 10 x 3 cm, oblanceolate, sessile or stalked; deeply cut down to costule into segments; pinnatifid at apex; segments 1.5 x 0.7 cm, oblong, sessile or decurrent, apex obtuse, margin bluntly lobed or crenate; rachis and costa pale-brown, glabrous or sparsely scaly; veins simple or forked. Sori about 0.2 cm long, oblong, usually in two rows, oblique to the costule, nearly scattered on the apical

segments; indusium pale-brown, attached on one side of the veinlets, oblique to the costule.

Not common; in forest clearings as well as in dense evergreen forests.

Fertile: July.

Distribution: BHUTAN, INDIA - Himalayas, Assam and Meghalaya.

Specimens examined: Jamir 6579 Dimapur (Kohima dist., 200 m).

Diplazium spectabile (Wall. ex Mett.) Ching in Lingnan Sc. J. 15: 278. 1936; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim Himalayas 116. 1964; Bir & Shukla in Bull. bot. Surv. India 8: 272. 1968; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 186.1975; Dhir, Ferns N.W. Himalayas 94. 1980.

Asplenium spectabile Wall. ex Mett. Abhandl. Senck. Naturforsch. Gesell. 3: 240. 1860.

Diplazium umbrosum var. multicaudatum Bedd., Handb. Ferns Brit. India 190, t. 91. 1883.

Asplenium multicaudatum Wall. (List. no. 229. 1928) ex Clarke in Trans. Linn. Soc. Lond. Ser. 2, (Bot.) 1: 502. 1880.

Rhizome up to 1 cm across, creeping, stout, terminal portion covered with dark-brown, linear-lanceolate scales. Stipes up to 50 cm long, erect, rather stout, dark-brown, scaly at base, sometimes muricate, lamina 60 - 100 x 30 - 60 cm, wide spreading, delto-lanceolate; primary pinnae up to 50 x 20 cm, deltoid to ovate-lanceolate, petiolate; secondary pinnae up to 15 x 5 cm, oblong-lanceolate, subsessile or shortly stalked, gradually acuminate at apex, tertiary pinnae or pinnules numerous, sessile, alternate; largest pinnule up to 2.5 x 1.2 cm, oblong, obtuse or rounded at apex, deeply cut down almost quite to costule into segments or lobes; segments up to 0.4 cm wide, slightly oblique, margin more or less deeply serrate; rachis and costae pale-brown, glabrous, texture thin, herbaceous, glabrous on both surfaces, pale-greenish, or brown when dry; veins simple or forked. Sori about 0.1 cm wide, oblong or subquadrate, closer to the midrib, slightly oblique; indusia pale-brown, attached at base.

Not common; collected only once.

Fertile: December.

Distribution: NEPAL, BHUTAN, BANGLADESH, INDIA: Himalayan region and Meghalaya.

Specimens examined: Jamir 7904 Kohima (Kohima dist., 1445 m).

Diplazium squamigerum (Mett.) C. Chr. in Bull. Soc. Fr. 52 Mem. 1. 51. 1905; DeVol & Kuo, Fl. Taiwan 1: 468. (ed. 2). 1980; Nair & Dixit in J. Bomb. nat. Hist. Soc. 78(3): 451. 1981.

Asplenium squamigerum Mett. in Ann. Lygd. Bot. 2: 239. 1866; Hope in J. Bomb. nat. Hist. Soc. 14: 259. 1902.

Rhizome short, erect to ascending, apex covered with lanceolate, denticulate, dark-brown scales; scales about 0.5 cm long; roots fibrous, black. Stipes 10 - 30 cm long, tufted, stramineous, densely scaly at base, sparsely above; lamina 25 - 45 x 6 - 10 cm, bipinnate to tripinnatifid; pinnae 20 - 25 pairs, alternate or subopposite, stalked or subsessile, the lower pinnae gradually shortened, usually basal pinnules very close to the rachis; largest pinnae up to 10 x 3 cm, delto-lanceolate, deeply cut down to rachis into segments or lobes, lobes up to 0.3 cm wide, margin sharply toothed; texture thin, herbaceous; rachis and costule stramineous, bearing scattered, linear, brown, short scales; veins fine, free, forked. Sori up to 0.2 cm long, linear, slightly curved, single, medial, oblique to the costule; indusia thin brown, entire or erose, attached at base, opening towards costa; spores short, stalked, brown.

Rather rare, in moist, humus covered, shady places in forests.

Fertile: October - December.

Distribution: CHINA, TAIWAN, JAPAN, INDIA - North India, (Jamu & Kashmir).

Specimens examined: Jamir 6335 Morong forests, Sangpur (Tuensang dist., 2134 m); 7258, 7259 Japvo Hill (Kohima dist., 2100 m).

A new record for N.E. India.

Diplazium subsinuatum (Wall. ex Hook. et Grev.) Tagawa, Coll.Ill. Jap. Pterid. 135. 203, Pl. 55. f. 298. 1959; et in Acta Phytotax. Geobot. 24: 63. 1969; Bedd., Handb., Ferns Brit. India 174. 1883; DeVol & Kuo, Fl. Taiwan 1: 468. (ed. 2). 1980.

Asplenium subsinuatum Wall. ex Hook. et Grev., Icon. Fil. 1: Pl. 27. 1827.

Diplazium lanceum Thunb., Fl. Jap. 333. 1784.

(Plate 105)

Mostly lithophytes. Rhizome up to 0.3 cm thick, wiry, densely clothed with narrowly lanceolate, dark-brown, entire, linear scales; scales about 0.5 cm long. Stipes 5 - 15 cm long, dark, covered with blackish, lanceolate scales; lamina 10 - 30 x 2 cm, simple, tapering at both ends, narrowly lanceolate, glabrous, margin entire or somewhat undulate, slightly crisped; texture coriaceous; costa slender, prominent beneath; veins free, forked, slightly hidden. Sori up to

1 cm long, linear, distant, medial, single or double, slightly oblique to the costa, nearly or half way reaching the margins; indusia up to 0.8 cm wide, narrowly linear, brown, margin crisped, free at both distal ends; sporangia long, slender-stalked; spores globose, dark-green; exine tuberculate.

Frequent on rock crevices near rivers.

Fertile: February - October.

Distribution: JAPAN, TAIWAN, CHINA, SRI LANKA, BALANGDESH, NEPAL, INDIA - Assam, Meghallaya.

Specimens examined: Jamir 7990 Changki Tzumet river (Mokokchung dist., 1000 m).

32. ASPIDIACEAE

Terrestrials, sometimes growing on rock crevices. Rhizome short or creeping, erect or suberect, sometimes covered with persistent leaf bases; vascular system dictyostelic. Stipes usually tufted, with a ring of several vascular bundles. Stipe and rhizome scales usually long, brown, narrowly linear, opaque, quite diverse in size, shape texture and colour; lamina pinnate to decompound; veins free or forked. Stipe and rachis grooved, rachis grooves open or not open to rachillae grooves. Sori usually round, dorsal or terminal on

veins; indusia usually present, round to reniform, peltate or fugacious, centrally attached or attached by a deep sinus, rarely absent.

A large family of about 32 genera; 11 in Nagaland.

K E Y T O G E N E R A

1a. Rachis not grooved or if grooved not open to rachilla grooves; usually multicellular (Ctenitis) hairs present along the dorsal surface of rachis, rachillae, and costae.

2a. Veins anastomosing.

3a. Sinus of each lobe (on frond) with an elevated tooth on the dorsal surface 7.Pleocnemia

3b. No such tooth present in the sinus.

4a. Basal pinnae with short basal basiscopic lobes or pinnules . .11. Heterogonium

4b. Basal pinnae unlobed, or if lobed with the largest basiscopic lobes or pinnules at the base . 9. Tectaria

2b. Veins free or only some anastomosing in fertile lamina.

5a. Rachis and rachillae scaly on the ventral surface . . . . . 10. *Ctenitis*

5b. Rachis and rachillae not scaly on the ventral surface . . 8. *Ctenitopsis*

1b. Rachis grooved on the upper surface, so as to open to rachilla grooves; Ctenitis hairs on rachis, rachillae and costae absent.

6a. Sori spherical, opening by regular longitudinal slits.

7a. Indusium globose, stalked . . . 1. *Peranema*

7b. Indusium sessile . . . . . 2. *Diacalpe*

6b. Sori otherwise, opening irregularly by the sides.

8a. Indusia peltate.

9a. Sori multiseriate or more or less scattered on either side of the costa; pinna with blunt tip . . 6. *Cyrtomium*

9b. Sori more or less in a single row along the margin; pinnae with prominent pointed tips . .5. *Polystichum*

8b. Indusia orbicular-reniform, attached by a sinus.

10a. Rhizome erect; fronds glabrous or hairy . . . . . 3. *Dryopteris*

10b. Rhizome long-creeping; fronds distant, scaly, rarely with multicellular hairs . . . 4. *Arachniodes*

1. Peranema

D. Don, Prodr. Fl. Nepal 12. 1825; C. Chr., Ind. Fil. 484. 1906; Copel., Gen. Fil. 106. 1947.

Terrestrials. Rhizome short, erect or suberect, massive, the apical part densely scaly; stipe stout, covered with scales, similar to rhizome scales; lamina pinnately decompound, hairs septate, glandular; veins free, forked. Sori spherical on a distinct stalk, superficial; indusium globose, bursting very irregularly at the apex; sporangia numerous; annulus oblique; spores bilateral.

A genus of 2 species; 1 in Nagaland.

Peranema cyatheoides D. Don, Prodr. Fl. Nepal 12. 1825; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 435. 1880; Bedd., Hnadb. Ferns Brit. India Suppl. 22, t. 11, 1892; et Handb. Ferns South India 73. 1863; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.). 189. 1975; Dhir, Ferns N.W. Himalayas 63. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 129. 1982.

Rhizome large, short-creeping, apex densely covered with deep-brown, entire, broad-lanceolate scales; scales up to 1.5 x 0.5 cm, Stipes 30 - 70 x 0.2 - 0.5 cm, erect, pale-brown, densely scaly; lamina 35 - 80 x 25 - 50 cm, tripinnate,

wide spreading, delto-lanceolate; pinnae alternate or sub-opposite, petiolate, largest pinnae up to 20 x 7 cm, oblanceolate, acuminate; largest pinnule 4 x 1.5 cm, obovate, sessile, decurrent, obtuse at apex, glabrous or finely hairy, pinnatifid, more or less deeply cut down to the costule into lobes or segments; lobes up to 1 x 0.5 cm, oblong, margin entire or crenate, apex obtuse; texture membranous; main rachis and costae scaly or pubescent; veins free, forked, clavate, sometimes indistinct. Sori globose, dorsal, superficial on veinlets, short-stalked, usually single on each lobe, rarely more than one; indusia inferior, globose, blackish-brown, stalked; spores oval, brown, hyaline; exine smooth.

Frequent in moist, shady places in forests; sometimes near streams.

Fertile: September - November.

Distribution: NEPAL, BHUTAN, INDIA - Western ghats, Meghalaya.

Specimens examined: Jamir 7207 Shamator (Tuensang dist., 692 m).

2. Diacalpe

Blume, Enum. Pl. Jav. 241. 1828; C. Chr., Ind. Fil. 219. 1906; Copel., Gen. Fil. 106. 1947.

Terrestrials. Rhizome short, suberect, rather stout, densely paleate; fronds pinnately compound bearing hairs and paleae, venation open, veinlets undivided. Sori spherical, sessile, usually seated on lower, anterior veinlets of each pinnule; indusia orbicular, closed, coriaceous, opening by apical slits; sporangia numerous; annulus slightly oblique.

Only species Diacalpe aspidioides Blume.

Diacalpe aspidioides Blume, Enum. Pl. Jav. 241. 1828; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 434. 1880; Bedd., Handb. Ferns Brit. India Suppl. 18. 1892; Holttum, Fl. Malaya 481. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 124. 1982.

(Plate 106)

Rhizome short, erect or suberect, black, densely covered with broad, thin, shining, brown scales; scales about 1 x 0.3 cm. Stipes 20 - 40 cm long, tufted, slender, reddish-brown, shining, densely scaly at base and sparsely above; lamina 20 - 50 x 15 - 25 cm, deeply tripinnate, rarely

quadri-pinnatifid, broadly delto-lanceolate; lateral pinnae 10 - 15 pairs, somewhat oblique, subopposite or alternate, petiolate or subsessile; largest basal pinnae up to 25 x 10 cm, oblanceolate, acuminate at apex; largest pinnule up to 8 x 3 cm, deltoid, deeply cut down to costule, obtuse at apex, largest tertiary branches about 1.5 x 1 cm, divided ultimately into lobes or segments, about 0.5 x 0.2 cm, oblong, cuneate, hairy on dorsal surface; texture thin, subcoriaceous; rachis and costule sparsely scaly, pubescent; veins free, forked, prominent. Sori medial on the anterior lower veinlets, solitary, round, brown; indusia spherical, firm, completely covering the sporangia when young, bursting irregularly at maturity; annulus dark-brown; spores irregular in shape, dark-brown; exine tuberculate.

Very common in high altitude forests.

Fertile: July - December.

Distribution: NEPAL, CHUTAN, SRI LANKA, MALAYA, INDIA: Meghalaya up to 1220 - 1829 m elevation.

Specimens examined: Jamir 6098 Peren (Kohima dist., 1446 m); 6120 Kohima (Kohima dist., 1445).

3. Dryopteris

Adanson, Fam. des Plantes 2: 20. 1763; C. Chr., Ind. Fil. 250. 1906; Copel., Gen. Fil. 121. 1947.

Terrestrial ferns. Rhizome short, stout, suberect or erect, covered with scales and persistent leaf bases. Stipes tufted, elongate, scaly at base, with several vascular bundles in a single ring; lamina pinnate to decompound, usually pinnatifid at apex, the lowest pair somewhat reduced or may be much the largest; pinnules on both sides of costa nearly equal in length or those on the basal side (basiscopic) longer than those in the upper (acroscopic) side, the lowest basiscopic pinnule often largest; margin of pinnules serrate or dentate; texture usually subcoriaceous, sometimes herbaceous; rachis and costae more or less clothed with small scales; veins free, simple or forked; Sori round, dorsal on veinlets; indusia large, reniform or orbicular, attached at the sinus, usually persistent, rarely absent; spores bilateral.

A fairly large genus of 150 species; 11 species in Nagaland.

K E Y T O S P E C I E S

1a. Fronds dimorphic . . . . . cochleata

1b. Fronds not dimorphic.

2a. Fronds unipinnate.

3a. Pinnae cut 1/3 way down to costa; scales with hooked margin, black, dense throughout the stipe and rachis . . . . . hirtipes

3b. Pinnae serrate or double serrate; scales entire, brown, only at the base of stipe . . . . . khasyana

2b. Fronds bi-tripinnate or bipinnatifid to decompound.

4a. Fronds tripinnate or tripinnatifid.

5a. Pinnae 1 - 4 cm apart; pinnules with more or less winged rachis; rhizome not massive . . . . . ramosa

5b. Pinnae 4 - 8 cm apart; pinnules without winged rachis; rhizome thick and massive with persistent leaf bases . . . . . fructuosa

4b. Fronds bipinnate or bipinnatifid to decompound.

6a. Stipe and rachis densely paleate.

7a. Rachis scales black; spores spinulose . . . . . lepidopoda

7b. Rachis scales black or brown; spores papillate . . . . . paleacea

6b. Stipe and rachis sparsely paleate or not; if paleate, palea thin and membranous.

8a. Stipe and rachis intermingled with scales or not.

9a. Stipe and rachis scales intermingled with long, pale fibrillose scales..sinofibrillosa

9b. Stipe and rachis scale not intermignled with such fibrillose scales . . . . . paleacea

8b. Stipe and rachis without intermingled scales.

10a. First basiscopic pinnule of lowest pinna much larger than the next pinnule . . . . . sparsa

10b. First basiscopic pinnule of the lowest pinna not larger than the next pinnule on the basiscopic side..

11a. Rhizome thick and massive with persistent leaf bases.

12a. Rhizome scales thin, membranous, shining brown; indusium large, prominent . . . . . fructuosa

12b. Rhizome scales shining brown mixed with shining black; indusium obscure . . . . . odontoloma

11b. Rhizome otherwise; indusium obscure . . marginata

✓ Dryopteris cochleata (D. Don) C. Chr., Ind. Fil. 258. 1906; Dhir, Ferns N.W. Himalayas 68. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 126. 1982.

Nephrodium cochleatum D. Don, Prodr. Fl. Nepal. 6. 1825; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 521. 1880.

Lastrea cochleata Bedd., Ferns South India t. 115. 1863.

Lastrea filix-mas var. cochleata Bedd., Handb. Ferns Brit. India 250, f. 130. 1883.

(Plate 107)

Rhizome semierect, fleshy, rather stout, apex densely clothed with pale-brown, thin, membranous, rather transparent, woolly, entire, lanceolate scales; scales about 2 x 0.4 cm. Stipes up to 100 cm long, tufted, pale-brown, woody, scaly at base, glabrous, above; fronds dimorphic,

glabrous; fertile ones contracted; lamina up to 100 cm long, bipinnate; pinnae numerous, alternate to subopposite, petiolate, sometimes the lowest pinnae somewhat shortened to the next above; largest pinnae up to 15 x 6 cm, petiolate, ovate-lanceolate, deeply cut down to the rachis into pinnules; pinnules numerous, sessile or decurrent at base, alternate; largest pinnule up to 4 x 1.5 cm, oblong, round or obtuse at apex, more or less deeply lobed at the margins, usually each lobe serrate or crenate at margins, texture coriaceous, rather pale-greenish when dry; rachis and costae pale-brown, smooth, glabrous, grooved above, rarely scaly; veins free, forked. Sori globose to reniform, rather large, usually completely covering the undersurface of the contracted fertile pinnules, pale-brown, reniform, membranous, orbicular; sporangia dark-brown; spores oval to round, dark; exine uneven.

Rare; in shady or open places in forest clearings; sometimes among bushes near villages and towns.

Fertile: January - October.

Distribution: MALAYA, INDIA - Western ghats, Himalayas and Meghalaya.

Specimens examined: Jamir 6304 Shamator (Tuensang dist., 1692 m).

Cryopteris fibrillosa (Clarke) Hand.Mzt., Akad. Anz. Akad. Wiss. Wiens. 2. 1922; DeVol & Kuo, Fl. Taiwan 1: 376 (ed. 2). 1980;
Nephrodium filix-mas var. parallelogramma subvar. fibrillosa Bedd., Handb. Ferns Brit. India 250. 1883.

Rhizome short, erect, rather stout, densely covered with thin, soft, pale-brown, lanceolate, hair-tipped scales; scales about 2 x 0.3 cm long, margin denticulate. Stipes 15 - 30 cm long, tufted, rather woody, densely covered with dark-brown scales intermingled with long fibrillose scales; lamina 20 - 40 x 10 - 25 cm, deeply bipinnatifid, delto-lanceolate; pinnae numerous, alternate, sessile; the lowest basal pair of pinnae somewhat reduced to the next above, broadest in the middle, gradually tapering to a lanceolate-acuminate apex; largest pinnae up to 12 x 2 cm, oblanceolate, sessile, gradually tapering to a lanceolate apex, pinnules numerous, alternate, usually closed and touching each other; largest pinnule up to 1 x 0.5 cm, bluntly obtuse at apex, margin serrate or crenate, texture coriaceous, glabrous above or both surfaces of lamina clothed with fibrillose scales; rachises with thin, pale-brown, linear scales. Sori small, round, in two rows on each pinnule, borne on upper and medial pinnae, indusium reniform, glabrous, yellowish-brown; margins recurved.

Frequent on shady forest floor at higher elevations.

Fertile: May.

Distribution: CHINA, KOREA, JAPAN, TAIWAN, NEPAL, BHUTAN, INDIA - Himalayas, Sikkim, Darjeeling.

Specimens examined: Jamir 7142 Kohima (Kohima dist., 1445 m).

Dryopteris fructuosa (C. Chr.) C. Chr., Ind. Fil. 267. 1906; Mehra & Bir in Res. Bull. (N.S.) Punjab Univ. 15: 132. 1964; Nair & Dixit in J. Bomb. nat. Hist. Soc. 78: 452. 1981.
Aspidium fructuosum C. Chr. in Bull. Soc. Fr. 52: 38. 1905.

Rhizome erect, massive, sometimes covered by old persistent bases of stipes, the apex densely clothed with thin, membranous, dark-brown, broad-lanceolate, acuminate scales; scales up to 3 x 0.7 cm. Stipes 30 - 60 cm long, rather stout, pale-brown, densely scaly at base, sparsely above; lamina 30 - 60 x 20 - 35 cm, bipinnate, broadly delto-lanceolate; pinnae numerous; stalked; largest pinna up to 30 x 10 cm, oblanceolate in outline, basal pinnule largest and gradually tapering into a narrowly lanceolate-caudate apex; pinnules numerous, alternate, distant,

shortly petiolate or decurrent to the costa; largest pinnule up to 7 x 2 cm, stalked, slightly acute, or obtuse, at apex, margin more or less deeply cut down nearly reaching the costule into lobes; each lobe up to 0.6 cm wide, obtuse, finely serrate; texture subcoriaceous, pale-brown when dry, glabrous on both surfaces; rachises and costae usually glabrous, often sparsely scaly; veins free, forked. Sori about 0.2 cm wide, rather large, yellowish-brown, usually in two rows in each pinnule or lobe, sometimes scattered; indusium large, reniform, peltate, pale-brown, entire; sporangia shortly stalked; spores oval, brown.

Common in moist shady places in forests, often near rivers and streams on slopes of mountains.

Fertile: December.

Distribution: INDIA - Lachen valley, North Sikkim.

Specimens examined: Jamir 6436 Zenheboto (Zenheboto dist., 1875 m).

A new record for N.E. India.

Dryopteris hirtipes (Blume) O.Kuntze, Rev. Gen. Pl. 2: 813. 1891; Baishya & Rao, Ferns & Fern-allies Meghalaya 126. 1982.

Aspidium hirtipes Blume, Enum. Pl. Jav. 148. 1828.

Lastrea atrata Presl.,Tent. Pterid. 77. 1836.

Nephrodium hirtipes Hook., Sp. Fil. 4: 115. t. 249. 1862.

Rhizome semierect, rather massive, stout, densely covered with blackish-brown, shining, thin, membranous, linear-lanceolate, hair-tipped scales; scales about 2.5 x 0.3 cm; stipes 20 - 45 cm long, tufted, stout, pale-brown to greenish, densely scaly at base; scales similar to rhizome scales but more darker; lamina 30 - 60 x 12 - 30 cm or more, simple pinnate, oblong to delto-lanceolate; pinnae numerous, alternate or subopposite, sessile or subsessile, the lower pinnae somewhat gradually attenuate, usually broadesh at middle, upper gradually shortened to a lanceolate-pinnatifid apex; largest pinna up to 18 x 2 cm or more, linear, oblanceolate, sessile, slightly oblique or unequal at base, gradually tapering to a lanceolate apex, margin rather falcately serrate or crenate; texture rather thin, coriaceous, pale-green when dry, glabrous above, sparsely scaly beneath; rachises and costae more or less densely clothed with blackish, linear scales; veins free, forked. Sori round, small, scattered, in 2 - 3 irregular

rows on either side of the costa; indusia small, reniform, pale-brown, membranous; sporangia small, shortly stalked; spores irregular in shape, dark; exine papillate.

Very common throughout the state; grows wither in shady or open places in forests.

Fertile: July - October.

Distribution: -INDIA - Darjeeling, Meghalaya.

Specimens examined: Jamir 6135 Phek (Phek dist., 1200 m); 6126, 6096 Kohima (Kohima dist., 1445 m); 6224 Changki (Mokokchung dist., 1000 m); 6154 Pfutsero (Phek dist., 2134 m); 6312, 6354 Shamator (Tuensang dist., 1372 m).

Dryopteris khasyana (Clarke) C. Chr., Ind. Fil. 272. 1906; Baishya & Rao, Ferns & Fern-allies Meghalaya 126. 1982.

Nephrodium filix-mas var. khasyana Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 519. 1880.

Dryopteris elongata O. Kuntze, Rev.Gen. Pl. 2: 811. 1891.

(Plate 108)

Rhizome short, erect to semierect, densely clothed with dark-brown, entire, linear-lanceolate scales; scales about 1.5 x 0.1 cm, Stipes tufted, 25 - 40 cm long, flattened, at base, ridged, dark-brown, densely clothed with scales at base and sparsely above; lamina 25 - 45 x 20 - 30 cm, imparipinnate, ovate-lanceolate; lateral pinnae numerous, alternate, shortly petiolate, usually 1 - 2 pairs adnate at the uppermost ones, often sessile; largest pinna up to 10 - 20 x 1 - 1.7 cm, linear or narrowly oblanceolate, shortly petiolate , slightly oblique at base, narrowly caudate-acute at apex, margin serrate; texture subcoriaceous, dark-green when dry, glabrous; rachises and costae dark-brown, more or less densely clothed with dark-brown, linear scales; veins dark-brown, free, forked more than once; veinlets reaching up to the margin of the pinnae. Sori small, round, scattered on the under-surface of the pinnae; indusium reniform; sporangia shortly stalked, brown; spores globose, brown, translucent; exine spinulose.

Frequent in shady places in forests; often in open places along rivers and ravines.

Fertile: July - October.

Distribution: INDIA - N.E. India.

Specimens examined: Jamir 6134 Phek (Phek dist., 1200 m).

Dryopteris lepidopoda Hayata, Icon. Pl. Form. 4: 161. f. 101. 1914; Tagawa in Acta Phytotax. 8: 23. 1939; et in J. Jap. Bot. 23: 77. 1949; H. Ito, Fil. Jap.Ill. Pl. 224. 1944; DeVol & Kuo, Fl. Taiwan 1: 378 (ed.2). 1980.

Dryopteris pachyphylla Hayata, Icon. Pl. Form. 4: 168, f. 103. 1914.

Dryopteris palacea var. khasyana (Clarke) C. Chr. in Contr. U.S. nat. Herb. 26: 280. 1930.

Dryopteris nigra Ching in Bull. Fan. Mem. Inst. Biol. 8: 430. 1938.

Rhizome semierect, blackish, shining, densely covered with thin, black to brown, membranous, fugaceous, lanceolate, acuminate scales; scales about 1.5 x 0.2 cm, margin ciliate. Stipes 10 - 20 cm long, tufted, blackish at base, pale-brown above, densely scaly throughout, lamina 25 - 45 x 15 - 25 cm, bipinnate, oblanceolate in outline; pinnae numerous, alternate, sessile or petiolate; the lowest basal pair not reduced, gradually tapering to a narrowly lanceolate apex; largest pinnae up to 13 x 2.3 cm, acuminate-caudate, shortly stalked; pinnules numerous, alternate, close and rather compact; largest pinnule up to 1.2 x 0.5 cm, oblong-subulate, obtuse, apices and sides sharply serrate and crisped, texture coriaceous, glabrous above, squamose beneath, pale-green when dry; rachises and costae more or less densely clothed

with black, fugacious, subulate, linear scales; veins free, forked. Sori large, round, brown, subcostal, in two rows on each pinnule ; indusium brown, reniform, membranous, entire; sporangia slender stalked; annulus of 10 - 18-celled, ferruginous; spores oval, brown; exine spinulose.

Frequent both in shady as well as in open places in forests.

Fertile: September - December.

Distribution: TIBET, CHINA, TAIWAN, INDIA - Himalayas Meghalaya.

Specimens examined: Jamir 6468 Kohima (Kohima dist., 1445 m).

✓ Dryopteris marginata (Wall. ex Clarke) C. Chr. in Philip. J. Sci. Bot. 2: 212. 1907; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 187. 1975$ Dhir & Datta, Nova Hedwigia, 27: 403. 1976; Dhir, Ferns N.W. Himalayas 69. 1980.

Nephrodium filix-mas var. marginata Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 521. 1880.

Nephrodium marginatum Hope in J. Bomb. nat. Hist. Soct. 14: 740, t. 33. 1903.

Rhizome short, erect, terminal part covered with thin, brown, broad-lanceolate scales; scales about 1 x 0.2 cm, Stipes 15 - 40 cm long, pale-brown, scaly at base, glabrous or sparsely scaly above; lamina 25 - 45 x 15 - 25 cm, bipinnate to tripinnate, broadly oblanceolate; pinnae numerous, alternate, petiolate; the lowest basal pinnae somewhat largest or equal to the next above, largest pinna up to 18 x 6.5 cm, oblanceolate in outline, petiolate, the lowest basal pinna largest and gradually tapering into a narrowly lanceolate, caudate apex, up to 4 x 1.8 cm, pinnules numerous, alternate, sessile or decurrent, pinnae subfalcate, bluntly obtuse or slightly acute, margin more or less deeply cut down almost reaching the costule; lobes up to 1 cm wide, obtuse, apices and sides finely serrate or crenate, texture subcoriaceous, pale-green when dry, glabrous above, often fibrillose on the lower surface; rachises and costules usually glabrous, pale-brown, sometimes sparsely scaly; veins free, forked. Sori about 0.2 cm wide, rather large, medial, in two rows on each pinnule or lobe; indusium large, pale-brown, reniform, glabrous, entire; sporangia shortly stalked; spores oval.

Frequent in slopes of moist deciduous forests and along roadsides in forests.

Fertile: July - October.

Distribution: INDIA - South India, Western ghats, Himalayas and Meghalaya up to 1525 - 2200 m elevation.

Specimens examined: Jamir 6307 Shamator (Tuensang dist., 1692 m); 6090 Kohima (Kohima dist., 1445 m).

✓ Dryopteris odontoloma (Moore) C. Chr. in Acta Hort. Gothob. 1: 59. 1924; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 187. 1975; Dhir & Datta, Nova Hedwigia 27: 400. 1976; Dhir, Ferns N.W. Himalayas 67. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 127. 1982.

Lastrea odontoloma Moore Ind. Fil. 90. 1858; Bedd., Handb. Ferns Brit. India 248. 1883.

Nephrodium filix-mas var. normalis Clarke in Trans. Linn. Soc. Bend. Ser. 2, (Bot.) 1: 519. t. 68. f. 2. 1880.

Nephrodium odontoloma Hope in J. Bomb. nat. Hist. Soc. 14: 736, t. 31. 1903.

Rhizome semi-erect, stout, densely covered with dark to brown, broad, oblong-acuminate to linear-lanceolate, membranous, entire scales; scales about 1.5 x 0.5 cm. Stipes 30 - 45 cm long, densely scaly at base, sparsely scaly or glabrous above, pale-yellowish to straw coloured;

lamina 35 - 55 x 12 - 25 cm or more, broadly oblong-lanceolate, petiolate, deeply cut down up to the rachis into secondary pinnae or pinnules; pinnules numerous, sessile or decurrent at base, alternate; largest pinnule up to 3.5 x 1.5 cm, elliptic-oblong, cordate to truncate at base, broadest just above base, obtuse to round with sharply serrate apex, margin more or less shallowly lobed, each lobe again serrate or crenate, texture subcoriaceous; rachis, costae and costules yellowish-brown, glabrous; lamina glabrous on both surfaces; veins forked once or twice, often more, free. Sori medial, globose, superficial on veins, flattened; indusium reniform or orbicular, fimbriate at base; sporangia long, slender stalked; spores round, dark-brown; exine tuberculate.

Frequent near forest edges in mountain slopes.

Fertile: November - December.

Distribution: INDIA - Himalayas and Meghalaya.

Specimens examined: Jamir 7241 Japvo Hills (Kohima dist., 2400 m).

- Dryopteris paleacea (Moore) Fomin in Kusn. et al. Fl. Cavc. Crit. 1(1): 52. 1911; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 187. 1975; Baishya & Rao, Ferns & Fern-allies Meghalaya 127. 1982.

Lastrea filix-mas var. paleacea Moore, nat. Pruit. Brit. Ferns (ed.1) 8: 178, 193, t. 33 (A). 1859.

(Plate 109)

Rhizome short, erect, stout, densely covered with dark-brown, thin, membranous, entire,linear, lanceolate scales; scales about 3 x 0.5 cm. Stipes 20 - 35 cm long, tufted, rather stout, flattened at base, usually densely covered with scales; scales similar to rhizome scales, but more darker; lamina 30 - 90 x 20 - 30 cm, bipinnate, ovate-lanceolate; pinnae numerous, alternate, sessile, usually close together, the lowest basal pair somewhat reduced, broadest in the middle, gradually tapering into a lanceolate, acuminate apex; largest pinnae up to 15 x 2 cm, oblanceolate, sessile,linear, lanceolate towards apex; pinnules numerous, alternate, deeply cut down almost to the costa, largest pinnules up to 1.2 x 0.6 cm, oblong,

obtuse at apex, margin crisped or serrate, texture coriaceous, glabrous above, squamose beneath along the costae and the costules; rachises rather densely covered with blackish-brown, linear scales; veins free, forked. Sori small, round, in two rows on each pinnule; indusium reniform, entire; spores oval to round, dark; exine papillate.

Frequent; in open places in forests at higher elevations.

Fertile: July.

Distribution: INDIA - Meghalaya.

Specimens examined: Jamir 7208 Kohima (Kohima dist., 1445 m).

Dryopteris ramosa (Hope) C. Chr., Ind. Fil. 287. 1906; Stewart in Bull. Torrey Bot. Cl. 72: 406. 1945; Dhir, Ferns N.W. Himalayas 69. 1980; Nair & Dixit in J. Bomb. nat. Hist. Soc. 78(3): 452. 1981. Nephrodium ramosum Hope in J. Bot. 126. 1896, etin in J. Bomb. nat. Hist. Soc. 14: 737. t. 32. 1903.

Rhizome short-creeping, more or less densely covered with thin, brown, linear-lanceolate scales; scales up to 1 cm long. Stipes up to 75 cm or more long, covered with

deciduous scales, rather greenish to straw-coloured when dry, grooved at base; lamina up to 80 x 30 cm, ovate to oblong-lanceolate in outline, tripinnate; primary pinnae up to 8 pairs or more, subopposite, distant, rather elliptic; largest up to 30 x 15 cm, ovate to oblong-lanceolate in outline, petioles up to 1.5 cm long; secondary pinnae 14 pairs or more, alternately arranged on secondary rachis; largest secondary pinnae up to 9 x 4 cm, ovate-oblong, usually petiolate, cordate to subtruncate at base, obtuse to acute at apex, deeply cut down up to tertiary pinnae or pinnules; largest pinnule up to 2 x 1 cm, oblong, adnate or sessile at base, obtuse or blunt with slightly serrate apex, margin shallowly lobed, texture thin, subcoriaceous; rachis sparsely covered with pale, linear scales; costae and costules light greenish to straw-coloured when dry, glabrous on both surfaces of lamina; veins free, forked twice or more. Sori medial, globose, brown; indusia thin, transparent, reniform or orbicular; sporangia short stalked; spores brown, round.

Frequent, grows on moist, humus covered forest floor; sometimes along roadsides in forests.

Fertile: December.

Distribution: INDIA - N.W. Himalayas.

Specimens examined: Jamir 7256 Japvo hills (Kohima dist., 1800 m).

A new distributional record for north-east India.

Dryopteris sparsa (D. Don) O. Kuntze, Rev. Gen. Pl. 2: 813. 1891; Holttum, Fl. Malaya 2: 492. Pl. 292. 1968; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 188. 1975; DeVol, Fl. Taiwan 380. 1980; Dhir, Ferns N.W. Himalayas 70. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 128. 1982.

Nephrodium sparsum D. Don, Prodr. Fl. Nepal. 6. 1825; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 523. 1880.

Lastrea sparsa Bedd., Ferns Brit. India 252. 1883.

(Plate 110)

Rhizome short, suberect, densely covered with broad-lanceolate, thin, membranous, reddish to pale-brown scales; scales about 1 x 0.3 cm. Stipes 15 - 40 cm long or more, tufted, shining, stipe scales sparse throughout, dark-purplish at base, pale-brown above; lamina 20 - 45 x 10 - 30 cm, bipinnate to tripinnate, delto-lanceolate, pinnae numerous, alternate to subopposite, petiolate, the lowest pair of basal pinnae the largest, about 20 x 10 cm, deltoid in outline, petiolate; pinnules numerous, subopposite to alternate, sessile or subsessile, deeply pinnatifid above, the first basiscopic pinnule of the lowest pinna much enlarged, about 5 x 2.5 cm, generally compound; other pinnules oblong,

slightly oblique or oblong, cut away at base, round at apex, margin usually more or less shallowly lobed or serrate, with a short, sharp tooth in between the lobes; texture subcoriaceous, pale-green or brownish when dry, glabrous on both surfaces; rachises and costa pale-green to brown, rather smooth, usually glabrous; veins free, forked terminating near the margin. Sori up to 0.2 cm wide, rather large, globose, usually one per lobe, medial on the acroscopic vein; indusium large, firm, pale-brown, reniform, entire; sporangia slender-stalked; spores oval, dark; exine smooth.

Commonest of the Dryopteris spp. in the state; usually grows in open jhummed forests and also along roadsides on hills.

Fertile: February - November.

Distribution: MALAYA, CHINA, JAPAN, TAIWAN, SRI LANKA, BURMA, INDIA:- widely distributed throughout India.

Specimens examined: Jamir 6245,6251 Mepongchuket (Mokokchung dist., 1200 m); 6202, 7045 Changki (Mokokchung dist., 1000 m); 6069 Pereng (Kohima dist., 1446 m); 6622 Mon (Mon dist., 898 m); 6467 Jejit (Mon dist., 100 m).

4. Arachniodes

Blume, Enum. Pl. Jav. 241. 1828; C.Chr., Ind. Fil.62. 1906.

Terrestrials. Rhizome short or long, creeping or sub-erect, covered with scales. Stipes scattered or tufted, scaly, sometimes with unicellular hairs; lamina simple pinnate to quadripinnate, anadromous; the ultimate pinnules usually rhomboid and aristate; veins free. Sori dorsal, subterminal on veins; indusia peltate or reniform, orbicular; sporangia stalked; annulus of about 14 thickened cells, vertical, spores bilateral.

A genus of about 50 species mostly confined to tropical and subtropical regions of the world; 3 species in Nagaland.

K E Y T O S P E C I E S

1a. Fronds tripinnate or tripinnatifid; sori small . . . . . aristata

1b. Fronds bipinnate.

2a. Stipes densely scaly at least up to 1/4 their length . . . . . speciosa

2b. Stipes very sparsely scaly or without scales . . . . . assamica

✓ Arachniodes aristata (Forst.f.) Tindale in Contr. N.S. Wales nat. Herb. 3: 89. 1961; Nair in Bull. bot. Surv. India 11: 185. 1969; DeVol & Kuo, Fl. Taiwan 1: 364 (ed.2). 1980; Dhir, Ferns N.W. Himalayas 77. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 124. 1982.

Polypodium aristatum Forst. f. Fl. Ins. Austr. Prodr. 82. 1786.

Aspidium aristatum (Forst.f.) Sw., Syn. Fil. 53. 1806; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 511. 1880.

Polypodium aristatum (Forst.f.) Presl, Tent. Pterid. 83. 1836.

Lastrea aristata (Forst.f.) Moore, Ind. Fil. 85. 1858; Bedd., Handb. Ferns Brit. India 229. 1883.

Dryopteris aristata (Forst.f.) Kuntze, Rev. Gen. Pl.2: 812. 1891.

Rumohra aristata (Forst.f.) Ching in Sinensia 5(23): 50. 486. 1954.

Rhizome short, creeping or suberect, the apical part densely covered with thin, shining, reddish-brown, linear-lanceolate scales; scales about 2 x 0.3 cm, distantly hooked at margin. Stipes up to 80 cm long, erect, scattered, rather stout, flattened at base, pale-brown, shining, densely scaly at base, sparsely above; lamina 60 - 80 x

30 - 50 cm or more, wide spreading, deltoid in outline, quadripinnatifid at base, tripinnate or pinnatifid at apex; lateral pinnae 5 - 7 pairs, alternate, petiolate; the lowest basal pinna or primary pinnae largest, up to 40 x 25 cm, tripinnate, ovate-lanceolate, petiole up to 4 cm long, secondary pinnae up to 18 x 8 cm, ovate-lanceolate in outline, bipinnate, stalked; tertiary pinna or leaflets up to 5 x 2.5 cm, ovate-oblong or deltoid, lanceolate, pinnatifid, base unequally cuneate, larger leaflets more or less deeply lobed near the base on the acroscopic side; lobes oblong, margins copious aristate, texture subcoriaceous, glabrous, shining above; main and secondary rachises more or less densely clothed with brown, lanceolate scales; veins free, forked. Sori rather large, reniform, terminal on veinlets; indusium reniform or orbicular, fugacious; sporangia long, slender stalked; spores oval, dark-brown; exine papillate.

Very common in dense shady places in forests as well as near ditches and water courses.

Fertile: July - February.

Distribution: CHINA, PAKISTAN, KOREA, JAPAN, TAIWAN, MALAYA, POLYNESIA, JAVA, INDIA - South India, very common in the western ghats; Himalayas; Meghalaya.

Specimens examined: Jamir 6095 Kohima (Kohima dist., 1445 m); 6250 Phek (Phek dist., 1200 m); 6507 Wokha (Wokha dist., 1314 m)

Arachniodes assamica (Kuhn.) Ching. Acta Bot. Sin. 10: 256. 1962; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 180. 1975; Nair & Dixit in J. Bomb. nat. Hist. Soc. 78: 444. 1981.

Aspidium assamicum Kuhn. in Linnaea 36: 108. 1869.

Polystichopsis assamica (Kuhn.) Tagawa in J. Jap. Bot. 33: 94. 1958.

Byrsopteris assamica (Kuhn.) Morton in Amer. Fern. J. 50: 153. 1960.

Rhizome short-creeping, stout, terminal portion densely covered with thin, brown, ovate to linear-lanceolate, acuminate hair-tipped scales; scales up to 0.8 x 0.2 cm. Stipes up to 60 cm long, erect to semierect, stout, scaly at base, sparsely above; lamina 30 - 60 x 18 - 30 cm, ovate-lanceolate in outline, bipinnate to tripinnatifid, lateral pinnae 3 - 8 pairs, petiolate, subopposite to alternate with a single terminal subdeltoid-acuminate pinna, the lowest pair of pinnae slightly reduced or not; largest lateral primary pinnae 15 - 30 x 5 - 10 cm, obovate to subdeltoid-lanceolate, stalked, deeply cut down up to main costae into secondary pinnae or pinnules; pinnules up to 12 pairs, alternate, sessile except the lowest pair which is shortly stalked; largest pinnule up to 8 x 2.5 cm, ovate-lanceolate, slightly falcate, slightly oblique at base, 1/4 of the lower base cut away,

lanceolate-acuminate, more or less deeply cut down into lobes or segments; the lowest acroscopic lobe largest, up to 1 cm wide, margin sparsely, sharply toothed, often entire, with a very sharp, acute apex or nearly aristate, texture subcoriaceous; rachises and costae sparsely covered with brown, linear-narrow scales and short hairs; lamina glabrous on both surfaces; veins pinnate in each lobe, simple or forked. Sori up to 0.2 cm wide, medial, rather large, globose, brown; indusium up to 1 cm wide, reniform to orbicular, dark-brown to pale-brown.

Frequent in moist, shady places in forests along river banks; sometimes on rock crevices.

Fertile: July - January.

Distribution: JAPAN, INDIA:-North-east India.

Specimens examined: Jamir 7270, 7284, 6099 Kohima Science College Road (Kohima dist., 1500 m).

Arachniodes speciosa (D. Don) Ching in Acta Botanica Sinica 10: 259. 1962; Mehra & Bir, Pterid. Fl. Darjeeling & Sikkim Himalayas 129. 1964.

Aspidium speciosum D. Don, Prodr. Fl. Nepal 5. 1825.

Aspidium aristatum var. affinis Clarke in Trans. Linn. Soc. SLond. Ser. 2, (Bot.) 1: 511. 1880.

Lastrea affinis sensu Bedd., Handb. Ferns Brit. India 230. 1883.

Dryopteris speciosa C. Chr., in Acta Hort. Goth. 7: 63. 1924.

Polystichum speciosum (D. Don) J. Smith in J. Bot. 4: 195. 1841.

Ruhmohra speciosa (D. Don) Ching in Sinensia 5: 53, Pl. 7. 1934.

Rhizome short creeping or suberect, apex densely covered with shining brown to dark-brown, narrowly linear-lanceolate, hair-tipped scales; scales up to 2 x 0.1 cm. Stipes up to 50 cm long, stout, pale-brown, densely scaly at base, scales similar to rhizome ones; lamina up to 45 x 20 cm or more, deltoid in outline, pinnate to tripinnate; lateral pinnae up to 6 pairs, alternate, petiolate, with a terminal pinna; the lowest pair about 20 x 6 cm, deltoid in outline, bipinnate towards the base; secondary pinnae up to 8 x 2.5 cm, deltoid to ovate-lanceolate, petiolate, deeply cut down, more or less quite to the rachis into segments or pinnules;

pinnules up to 2 x 1 cm, oblong to subrhomboidal, sessile, rounded to acute; margin more or less deeply lobed, the upper basal lobe deepest, each lobe toothed or aristate, texture coriaceous; rachis, costae and costules clothed with dark-brown fibrillae; veins simple or forked, free, pinnate in the lobes. Sori up to 0.2 cm wide, large, brown, apical on the veinlets; indusium brown, large, reniform to orbicular.

Rare on rock crevices near river banks and also on hill slopes, particularly in shady places.

Fertile: December.

Distribution: NEPAL, INDIA: - Assam, Sikkim, Darjeeling and Meghalaya.

Specimens examined: Jamir 6474 Kohima (Kohima dist., 1445 m).

5. Polystichum

Roth, Tent. Fl. Germ. 3: 31, 69. 1799; C. Chr., Ind. Fil. 575. 1906; Copel., Gen. Fil. 108, 1947.

Terrestrial ferns. Rhizome usually short, stout, ascending, scaly. Stipes tufted, scaly; lamina ovate-lan-

ceolate, pinnate to bipinnate, sometimes simple or tripinnate; rachis glabrous or scaly, often proliferating with a terminal bud at the truncate or retuse apex; segments usually anadromous, mainly auriculate, acroscopically developed, margin usually serrate, aristate, texture, chartaceous to coriaceous or herbaceous; veins simple or pinnately forked, veinlets all free. Sori round, terminal or subterminal, dorsal; indusium orbicular, superior, centrally or excentrally peltate, persistent or caducous, rarely absent; sporangia stalked; annulus vertical, incomplete; spores bilateral, usually oblong.

A large genus of about 200 species; 12 species in Nagaland.

K E Y T O S P E C I E S

1a. Fronds unipinnate.

2a. Apex of frond bearing proliferating vegetative buds; stipe and rachis with dense scales, of 2 types; pinnae lobed, the basal acroscopic lobe larger and deeply divided . . . . . lentum

2b. Apex of frond without vegetative buds; stipes and rachis not scaly or with very few scattered scales of one type only; pinnae toothed . . . . . auriculatum

1b. Fronds bipinnate.

3a. Scales membranous.

4a. Scales conduplicately curved . . biaristatum

4b. Scales not curved; rachis and stipe densely covered with reddish-brown, multicellular hairs . . . . . setiferum

3b. Scales usually thick, with dark strips in the middle, and hyaline margins.

5a. Stipes and rachis more or less densely scaly, scales of at least two types.

6a. Pinnae straight.

7a. Stipe often sparsely scaly; margins of pinnules with sharp hair-pointed serrations . . discretum

7b. Stipe densely scaly; margins of pinnules with hair-pointed serrations or not.

8a. Terminal portion of fronds with proliferating buds . . prolificans

8b. Terminal portion of fronds otherwise . . . . . aculeatum

6b. Pinnae falcate, less than 10 cm long; scales on the stipe and rachis dense.

9a. Scales of 3 types; scales on the rachis shining black with hyaline margin . . . . . heteropaleaceum

9b. Scales of 2 types; scales on rachis hyaline, membranous . . . nigropoleaceum

5b. Stipe and rachis paleate and sparsely scaly (if present).

10a. Fertile and sterile regions separated in the fronds; indusium broad, entire . . . . . semifertile

10b. Fertile and sterile regions not separated; indusium small lobed.

11a. Pinnules 2 - 2.8 cm long, 0.4 - 0.5 cm broad . . . . . longipinnulum

11b. Pinnules 1.5 - 2.2 cm long, 1 - 1.2 cm broad.

12a. Terminal portion with proliferating buds . . . . . prolificans

12b. Terminal portion without such buds.

13a. Pinnules 2 - 3.5 x 1 - 1.5 cm, margin entire or crenate . . . . birii

13b. Pinnules 1 - 2.5 x 0.5 - 1 cm, margin with sharp hair-pointed serrations . . . aculeatum

✓ Polystichum aculeatum (Linn.) Roth in Rom. Arch. 2: 106. 1799; Bedd., Handb. Ferns Brit. India 207. 1883; Mehra & Bir in Res. Bull. (N.S.) Punjab Univ. 15: 127. 1964; Dhir, Ferns N.W. Himalayas 74. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 132. 1982.

Polypodium aculeatum Linn., Sp. Pl. 1552. 1753.

Polystichum aculeatum (Linn.) Bedd., Ferns South India t. 121, 122. 1863; et Handb. Ferns Brit. India 207. 1883.

Aspidium aculeatum (Linn.) Sw. in Schrad. J. Bot. 2: 37. 1800; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 509. 1880.

Rhizome erect or semierect, stout, densely covered with scales; scales broad, thick, blackish-brown, margin pale-yellowish, ovate-lanceolate, acuminate, about 1.5 x 0.3 cm or more, intermixed with large, ovate ones. Stipes 20 - 50 cm long, tufted, also densely scaly at base, sparsely above, mixed with dark-brown ramentae; lamina 30 - 65 x 15 - 30 cm, bipinnate, ovate-lanceolate; pinnae numerous, alternate, petiolate, slightly tapering to the base, the lower most basal pinnae much shorter than those in the above, gradually tapering to a long lanceolate-acute apex, largest pinnae 15 - 20 x 3 - 5 cm, linear, oblanceolate, shortly stalked, slightly unequal at base, acuminate at apex; pinnules numerous, alternate, very shortly stalked;

largest pinnule up to 2.5 x 1 cm, oblong, auricled at the upper basal region, slightly cuneate at lower base, blunt or slightly acute at apex, margin toothed, each tooth ending in a stiff point, texture soft, more or less coriaceous, pale-green when dry, glabrous above, very sparsely pubescent on the undersurface; rachis and costae more or less densely clothed with dark-brown, lanceolate scales; veins free, forked in the segment of the pinnules. Sori on the veinlets, rather large, round; indusium about 0.1 cm wide, peltate, margin slightly lobed; spores round, brown; exine smooth.

Very common throughout the state, in forests as well as along roadsides.

Fertile: February.

Distribution: INDIA - throughout the Indian region on the mountains.

Specimens examined: Jamir 7015, 7013 Changki (Mokokchung dist., 1000 m).

Polystichum auriculatum (Linn.) Presl, Tent. Pterid. 83. 1836; Bedd., Handb. Ferns Brit. India Suppl. 203. 1892; Baishya & Rao, Ferns & Fern-allies Meghalaya 132. 1982.

Polypodium auriculatum Linn., Sp. Pl. 1088. 1753.

Aspidium auriculata (Linn.) Sw., Syn. Fil. 44. 1806; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 506. 1880.

(Plate 111)

Rhizome short, erect or suberect; roots numerous, wide-spreading; stipes 5 - 15 cm long, tufted, covered with dark-brown, linear-lanceolate scales; scales about 1 x 0.3 cm; lamina 15 - 40 x 2.5 - 5.5 cm, simple pinnate, linear, oblanceolate, rather attenuated at the basal pinnae, apex narrowly pinnatifid; pinnae numerous, subsessile, alternate; largest pinnae 1 - 3 x 0.5 - 1 cm, subrhombic-oblong to falcate-lanceolate, auricled at the upper basal margin, slightly cuneate at the lower base, obtuse to acuminate at apex, margin finely serrate, lower margin nearly entire; rachis sparsely covered by small, short scales; texture coriaceous, slightly scaly beneath, glabrous above; veins free, forked. Sori small, arranged in two rows near the costae; indusium small, slightly denticulate, often absent.

Not a common species, occasional among rock crevices.

Fertile: January - November.

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Distribution: SRI LANKA, FORMOSA, INDIA:- throughout India (very common in South); Meghalaya.

Specimens examined: Jamir 6048 Peren (Kohima dist., 1446 m).

Polystichum biaristatum (Blume) Moore, Ind. Fil. 86. 1858; C. Chr. in Contr. U.S. Nat. Herb. 26: 1287. 1931; Mehra & Bir in Res. Bull (N.S.) Punjab Univ. 15: 178. 1964; Dhir, Ferns N.W. Himalayas 75. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 132. 1982.

Aspidium biaristatum Blume, Enum. Pl. Jav. 164. 1828; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 510. 1880;

Polystichum aculeatum var. durissima Rost. Hedw. 56: 339. 1915.

Polystichum subapiciflorum Hayata, Icon. Pl. Form. 5: 335. f. 140. 1915.

Polystichum aculeatum var. biaristatum (Blume) Bedd., Handb. Ferns Brit. India 209. 1883.

Rhizome short, stout, semierect; roots wiry, long spreading. Stipes up to 20 - 55 cm long, tufted, erect, rather stout, pale-brown, base densely scaly; scales

centrally thick and blackish, margin pale, thin, conduplicately curved, broad-lanceolate, about 2.5 x 0.5 cm; lamina 30 - 75 x 15 - 30 cm, bipinnate, lanceolate, often delto-lanceolate; pinnae numerous, alternate, subsessile or shortly petiolate, the lowest basal pinnae somewhat reduced to the next above; largest pinnae up to 10 - 20 x 2.5 - 6 cm, linear, delto-lanceolate, shortly stalked, apex long acuminate, base truncate; pinnules up to 1.5 - 3 x 0.5 - 1.5 cm, oblong-falcate, more or less auricled at the upper basal margin, lower base slightly cuneate, margin sparsely serrate or spinulose; rachises and costae more or less densely covered with dark-brown palea; texture coriaceous, small, short, scaly on the undersurface of the lamina; veins free, forked. Sori rather large, usually terminal on the veinlets, dark-brown; receptacles of sori protruberant; indusium peltate, margin denticulate, pale-brown; spores round, yellowish, small, exine smooth.

Extremely common in moist, shady places as well as in open areas.

Fertile: February - October.

Distribution: SRI LANKA, BURMA, VIETNAM, WEST CHINA, JAVA, TAIWAN, MALAYA, INDIA: - Assam, Meghalaya, N.W. Himalayas, Darjeeling.

Specimens examined: Jamir 6523, 6524 Wokha (Wokha dist., 1314 m); 6470 Zehheboto (Zenheboto dist., 1875 m).

Polystichum birii, Sp. nov.

(Plate 112)

Rhizome short, erect to semierect, stout, apical part densely scaly; scales broad, ovate-lanceolate, dark-brown in the middle, pale in the margin, fimbriate, up to 2 x 0.5 cm. Stipes up to 30 - 60 cm long, tufted, stout, pale-greenish, densely scaly particularly at base, scales similar to rhizome scales; lamina up to 50 - 80 x 25 - 35 cm or more, oblong-acuminate in outline; bipinnate; apical part often with proliferating vegetative buds; lateral pinnae 6 - 15 pairs, subopposite to alternate, shortly stalked; the lowest pair somewhat reduced to above; largest pinnae up to 16 - 22 x 4 - 6 cm, oblong-lanceolate, pinnate, shortly stalked (stalk about 0.4 cm long); apex acuminate, deeply cut down up to costa into pinnules; pinnules numerous, closely placed , up to 15 pairs, very shortly stalked except the uppermost 2 - 3 pairs which are adnate or decurrent; largest pinnules up to 2 - 3.5 x 1 - 1.5 cm, suboblong, falcate, shortly stalked, the base auricled or often lobed at the acroscopic side, narrowly cut away or cuneate below, apex shortly acute or often blunt, margin crenate or entire; rachis and costae more or less densely clothed with brown, linear scales on

both surfaces ; costules bearing small scales beneath, glabrous above, pale greenish when dry; veins distinct, oblique, dichotomously forked or branched up to margin. Sori up to 0.2 cm wide, rather large, globose, brown, borne on the acroscopic veinlet; indusium small, falling off at maturity.

Frequent in moist, shady places in dense forest. This species is very closely allied to P. aculeatum and P. prolificans but differs mainly in the shape and size of pinnules and in stipe scales.

Fertile: July - February.

Distribution: Nagaland.

Specimens examined: HOLOTYPE Jamir 6691 A Isotype 6691B &C. (NEHU) Kohima (Kohima dist., 1700 m); 6469, 6524, Wokha (Wokha dist., 1300 m); 7015 Changki (Mokokchung dist., 1000 m); (It is proposed to deposit the Holotype in CAL after the valid publication of this taxon).

The specific epithet birii is coined after Prof. S. S. Bir, who is a renowned pteridologist of the country.

Polystichum discretum (D. Don) Diels, Nat. Pfl. 1: 199. 1899; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 190. 1975; Dhir, Ferns N.W. Himalayas 75. 1980.

Aspidium discretum D. Don, Prodr. Fl. Nepal 4.1825.

Rhizome erect, stout, densely scaly at base; scales centrally black and thick, margin pale-brown, lanceolate, about 1.5 x 0.3 cm, lamina 35 - 55 x 15 - 30 cm, bipinnate, delto-lanceolate; pinnae numerous, alternate, petiolate; largest pinna 15 x 3 cm, lanceolate, narrowly acuminate at apex; pinnules numerous, alternate, shortly stalked or subsessile; largest pinnule 1.7 x 0.7 cm, oblong, shortly stalked, auricled at the upper basal margin, slightly cuneate below, obtuse or acute at apex, margin shortly serrate; texture coriaceous, pale-green when dry, glabrous on the upper and slightly pubescent on the undersurface; rachises and costae more or less clothed with dark-brown, linear-lanceolate scales; veins free, forked. Sori on the veinlets, more or less near the costule, small round, reniform, margin slightly lobed; spores round, exine smooth.

Not common; in moist shady places on hill slopes.

Fertile: May - October.

Distribution: INDIA - N. W. Himalayas.

Specimens examined: Jamir 7127 Kohima (Kohima dist., 1445 m); 6588 Mon (Mon dist., 898 m).

Polystichum heteropaleaceum Nair & Nag in J. Bomb. nat. Hist. Soc. 75(1): 153 - 156. 1977; Nair & Dixit in J. Bomb. nat. Hist. Soc. 78: 459. 1981; Baishya & Rao, Ferns & Fern-allies Meghalaya 132. 1982.

Rhizome erect, rather stout, massive forming a small trunk, densely covered with two types of scales, one type broadly lanceolate, 2 x 0.8 cm, centrally thick and dark, margin pale-brown, thin, rather transparent, membranous, acuminate, the other type linear, pale-brown, narrowly lanceolate, hair-tipped. Stipes 20 - 35 cm long, tufted, rather stout, pale-brown, densely scaly at base, and sparsely above; lamina 30 - 40 x 12 - 20 cm, bipinnate, ovate-lanceolate; pinnae numerous, subopposite or alternate, sessile, the lowest basal pair somewhat reduced to the next above, broadest nearly to the middle and gradually tapering to a narrowly lanceolate acuminate apex; largest pinnae up to 15 x 2 cm, linear, oblong-lanceolate, slightly oblique to the rachis, sessile; pinnules numerous, alternate, usually closely attached, sessile or decurrent; largest pinnule 1 x 0.6 cm, auricled at upper base and lower margin excised, margin sharply toothed; texture coriaceous, pale-green to brownish when dry, slightly pubescent under-

neath and glabrous above; rachis and costae more or less densely clothed with scales similar to those of stipes; veins free, forked. Sori rather large, globose; annulus yellowish-brown; spores round, dark; exine smooth.

Frequent on moist, shady forest floors; sometimes along roadsides on hills.

Fertile: February - December.

Distribution: INDIA:- throughout Himalayas, Meghalaya.

Specimens examined: Jamir 7150 Kohima (Kohima dist., 445 m).

Polystichum lentum (D. Don) Moore, Ind. Fil. 86. 1858; Mehra & Bir, Res. Bull. (N.S.) Punjab Univ. 15: 126. 1964; Dhir, Ferns N. W. Himalayas 72. 1980; Baishya & Pao, Ferns & Fern-allies Meghalaya 132. 1982.
Aspidium lentum D Don, Prodr. Fl. Nepal 4. 1825.
Aspidium auriculatum Sw. var. lentum sensu Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 507. 1880.
Aspidium auriculatum Sw. var. subbipinnata sensu Bedd., Ferns Brit. India t. 136. 1866; et Handb. Ferns Brit. India 204. 1883.

Rhizome short, erect, or suberect apex densely covered with scales; scales oblique-ovate, dark-brown in the middle, pale and thin at margins, acuminate, about 1.2 x 0.4 cm, roots wiry, wide spreading. Stipes 5 - 13 cm long, tufted, densely scaly at base; scales similar to that of rhizome scales; lamina 30 - 50 x 6 - 8 cm, unipinnate, oblanceolate, pinnae up to 40 pairs, alternate, subsessile, the lowest basal pinnae somewhat reduced to the next; the apical pinnae gradually tapering, pinnatifid, usually bearing proliferous, young vegetative buds; largest pinnae up to 2 - 4 x 1 - 1.5 cm, oblong to slightly falcate, surface paleate; rachis grooved on the upper surface, densely covered with small, short, hair-like, brown scales; texture subcoriaceous; veins free, forked. Sori up to 0.2 cm wide or more, rather large, reniform; indusia about 0.2 cm, pale-brown, attached at the middle, suborbicular, margin entire.

Not common noted in open and shady places.

Fertile: May - October.

Distribution: INDIA - Throughout the Himalayas and Meghalaya up to 457 - 2439 m elevation.

Specimens examined: Jamir 7205 Changki (Mokokchung dist., 1000 m).

Polystichum longipinnulum N.C.Nair in Amer. Fern J. 64(1): 15. 1974; Nair & Dixit in J. Bomb. nat. Hist. Soc. 78: 459. 1981.

Rhizome short, erect to suberect. Stipes 30 - 55 cm long, pale-brown, densely covered with large, shining, dark-brown scales; scales up to 1.5 x 0.4 cm, pale, hyaline in margin, lanceolate, hair-tipped at the base, fibrillose brown throughout stipes, rachis and pinna midribs; lamina 30 - 70 x 20 - 30 cm, triangular, bipinnate, the basal (or rarely the subbasal) pinnae the largest, the upper gradually reduced, largest pinnae up to 18 x 3.5 cm, alternate, sessile, or subsessile, closely pinnate throughout, pinnules opposite or alternate, subsessile or shortly stalked, not decurrent, linear-lanceolate, acute at base with a prominent auricled, acroscopic base, basiscopic base narrowed to the midrib, margins spinulose on basiscopic side, those of the lower pinnules deeply lobed or pinnatifid, aristate; the largest pinnule up to 2.5 x 0,7 cm; texture thin, subcoriaceous; lower surface of the lamina very sparsely scaly or glabrous; upper surface glabrous when old; veins free, forked once. Sori up to 10 pairs per pinnule, 1 - 3 pairs on the auricled lobe; indusium rather small, brown, peltate, not covering the sorus at maturity, sometimes deciduous.

Abundant in dense forests on hill slopes often on humus covered rocks.

Fertile: February.

Distribution: NEPAL, INDIA:- Darjeeling, Himalayas, South India.

Specimens examined: Jamir 7956 Changki (Mokokchung dist., 1000 m).

Polystichum nigropaleaceum (C.Chr.) Diels, Nat. Pfl. 1: 191. 1899; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.). 190. 1975.

Rhizome short, erect, apex densely scaly; scales black at the back, thick, margin thin, pale-brown, membranous, broad lanceolate, about 1.2 x 0.3 cm. Stipes 6 - 15 cm long, erect, pale-brown, densely scaly at base, rather sparsely above, stipe scales similar to the rhizome scales; lamina 15 - 30 x 5 - 10 cm, bipinnate, narrowly oblanceolate; pinnae numerous, alternate, sessile or subsessile; largest pinnae 5 x 1.5 cm, oblanceolate, subsessile, acuminate; pinnules 3 - 10 pairs in a single pinna, alternate, sessile, largest pinnule up to 1.2 x 0.6 cm, oblong-rhomboid, sessile, usually auricled at the upper basal margin, slightly cuneate below, blunt or rather acute at apex; margin serrate, each serration ending in a sharp spine-like point, texture subcoriaceous, pale-green when dry, glabrous above, more or less pubescent beneath; rachis and costae more or

less densely clothed with dark-brown, linear-lanceolate scales; veins free, forked. Sori small, round; indusium reniform, thin, pale-brown; spores dark-brown.

Rare; collected only once in an evergreen forest on hills.

Fertile: December.

Distribution: INDIA.

Specimens examined: Jamir 6428 Zenheboto (Zenheboto dist., 1875 m).

Polystichum prolificans A.R., in Bull. Jard. Bot. Buitenz. Ser 3, 2: 170. 1922; Holttum, Fl. Malaya 2: 490. 1968.

(Plate 113)

Rhizome short, rather massive, stout, the apical part densely covered with broad, ovate-lanceolate, shining scales which are dark in the centre and pale-brown and fimbriate in the margin; scales up to 2 x 0.5 cm. Stipes up to 30 - 60 cm long, stout, pale-brown, rather densely scaly at base, stipe scales similar to rhizome scales; lamina up to 60 - 90 x 25 - 35 cm or more, deltoid to ovate-lanceolate in outline, bipinnate; lateral pinnae up to 10 - 15 pairs, subopposite or alternate, petiolate, the lowest

pair somewhat shortened; sub-basal pinnae largest, upper pinnae very gradually reduced, bearing a proliferous bud in its axil; largest pinnae up to 30 x 6 cm, linear, ovate-lanceolate, shortly stalked (stalk up to 0.6 cm long), deeply cut down up to the costa into pinnules; pinnules up to 4 x 1.5 cm, shortly stalked, slightly falcate, the basal acroscopic side auriculate, narrowly cuneate or cut away below, apex acute or slightly blunt, margin shallowly crenate or lobed; the apices of the lobes not aristate; texture subcoriacrous, rachises and costae more or less densely covered with very narrow hair-like, brown scales, pale-greenish when dry, hairy beneath, glabrous above; veins distinct, forked several times, alternate. Sori up to 0.1 cm wide, small, globose, medial, borne on the tip of the acroscopic vein, rather near the costa; indusium small, firm, brownish, reniform, not covering the sorus at maturity.

Extremely rare; on moist, shady hill slopes. The proliferating vegetative buds are densely rooting.

Fertile: December - February.

Distribution: MALAYA, SUMATRA, INDIA - Nagaland.

Specimens examined: Jamir 7249 Japvo hill (Kohima dist., 2400 m); 7016, 7955 Changki/Alarimeru (Mokokchung dist., 000 m).

A new record for India.

Polystichum semifertile (Clarke) Ching in Lingn. Sci. J. 15: 398. 1936; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 190. 1975; Baishya & Rao, Ferns & Ferns allies Meghalaya 134. 1982.

Polystichum aculeatum var. semifertile Bedd., Handb. Ferns Brit. India 209. 1883; Mehra & Bir, in Res. Bull. (N.S.) Punjab Univ. 15: 128. 1964.

Aspidium aculeatum var. semifertile Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 509. 1880.

Rhizome erect or semierect, densely covered with scales; scales broad, thick, black-brown in the central portion, and pale-brown at the margin, membranous, lanceolate-acute, about 1 - 2 x 0.5 - 1 cm. Stipes 25 - 35 cm long, slender, tufted, densely scaly at base, scales similar to rhizome scales; sparsely covered with dark-brown ramentae above; lamina 30 - 45 x 20 - 30 cm, ovate-lanceolate, bipinnate; pinnae numerous, subopposite or alternate, petiolate; the lowest basal pair somewhat reduced to the next above, broadest in the middle and gradually tapering to a lanceolate acuminate apex, largest pinna up to 15 x 2 cm, linear, lanceolate, acuminate at apex, shortly stalked; pinnules numerous, alternate, sthortly stalked; largest pinnule up to 2 x 0.8 cm, oblong, very shortly stalked, auricled at the upper basal margin, slightly cuneate at the lower base, obtuse or acute at apex, margin finely serrate, ending in

a sharp pointed tip, texture coriaceous, pale-green when dry, sparsely pubescent beneath; rachis and costae more or less clothed with dark-brown, linear-lanceolate scales; basal portion of lamina fertile, upper part sterile, often a few pairs of pinnae completely sterile on the apical part, veins free, forked. Sori rather large, round; indusium small, entire; spores oval, dark, exine papillate.

Not common; collected in a shady places in mountain forests.

Fertile: October- December.

Distribution: INDIA - Sikkim, Meghalaya.

Specimens examined: Jamir 6466, 6467 Kohima peak (Kohima dist., 1445 m); 6525 Wokha (Wokha dist., 1314 m).

Polystichum setiferum (Forsk.) Moore ex Woynar, Mitt. Naturw. ver. Steirmark, 49: 181. 1913.

Rhizome short, erect, densely colvered with thin, red-brown, broad-lanceolate scales; scales about 1.2 x 0.2 cm, slender, hair-like, linear scales mixed with larger, brown ones; Stipes 8 - 13 cm long, shining, brown, clothed with pale-brown scales, intermixed with some ovate ones;

lamina 20 - 30 x 8 - 12 cm, bipinnate, lanceolate; pinnae 18 - 23 pairs, subsessile or shortly stalked, alternate; the lowest basal pinnae somewhat reduced to the next, broadest in the middle and gradually tapering to a long, lanceolate-acuminate apex; largest pinnae up to 3 - 5 x 1- 2 cm, shortly stalked, slightly unequal at the base, narrowly oblanceolate in outline, rather pointed or acuminate at the apex; pinnules numerous, 3 - 12 pairs, spaced far apart, alternate, sessile or subsessile, about 0.1 cm long; largest pinnule up to 1.3 x 0.6 cm, ovate-oblong, slightly auricled at the upper base and very shortly cuneate at the apex, with a well developed lobe on the side nearest the apex of the pinna; margin toothed, each tooth ending in a long spine-like point, texture soft, subcoriaceous, glabrous above, more or less densely clothed with small hair-like scales on the lower surface; rachises and costae more or less densely clothed with small, dark-brown scales. Sori rather large, reniform; indusium about 0.1 cm wide, pale-brown, peltate, suborbicualr, margin entire.

Common in partially shaded localities in forests.

Fertile: July.

Distribution: INDIA - Western Himalayas.

Specimens examined: Jamir 6131 Phek (Phek dist., 1200 m)

A new distributional record for north-east India.

6. Cyrtomium

Presl, Tent. Pterid. 86. 1836; C. Chr., Ind. Fil. 202. 1906; Copel., Gen. Fil. 110. 1947.

Terrestrials. Rhizome short, ascending or erect, rather stout, densely covered with scales. Stipe erect, long, scaly; lamina pinnately compound; texture firm; veins free, forked. Sori globose, scattered, borne on the included, free veinlets; indusium peltate; sporangia numerous; annulus of about 10 - 17 thickened cells, oblique; spores bilateral, tuberculate.

Species about 10; 2 species in Nagaland.

K E Y T O S P E C I E S

Lamina with a distinct terminal pinna,
margins of pinnae sharply serrate;
indusium serrate . . . . . caryotideum

Lamina without distinct terminal pinna;
pinnae margins entire or undulate;
indusium entire . . . . . hookerianum .

Cyrtomium caryotideum (Wall.) Presl, Tent. Pterid. 86. Pl. 2. f. 26. 1836; Mehra & Bir, Res. Bull. Punjab Univ. (N.S.) 15: 129. 1964; Ching in Acta Phytotax. Sin. Additam. 1: 41. 1965; Dhir, Ferns N.W. Himalayas 78. 1980.

Aspidium falcatum Clarke in Trans. Linn. Soc. Lond. Ser. 2, (Bot.) 1: 512. 1880 (pro parte).

Cyrtomium falcatum Sw. var. caryotideum (Wall.) Bedd., Handb. Ferns Brit. India 212. t. 106. 1883.

(Plate 115)

Rhizome short, ascending or erect; roots spreading. Stipes 8 - 20 x 0.2 - 0.5 cm, tufted, densely covered with oblong-ovate, lanceolate-acuminate, dark-brown scales; scales about 1 x 0.2 cm, lamina up to 25 - 40 x 8 - 15 cm, simple pinnate, imparipinnate; pinnae about 7 - 13 pairs, alternate, petiolate or subsessile; the lowest basal pair somewhat reduced than the next above, and usually sterile; largest pinnae up to 7 x 2 cm, ovate-lanceolate, falcate, acuminate, shortly stalked, cuneate at base, broadly auriculate on the upper side, acuminate at apex; margin minutely and sharply serrate; texture coriaceous, green, glabrous; rachis green, covered with small hairs and sometimes with short, pale-brown scales; veins obscure, except the midrib. Sori globose, scattered, submarginal; indusia peltate, orbicular, serrulate, sporangia shortly stalked; spores dark, round

Frequent along roadsides and river banks. This species prefers moist and shady habitats for a luxuriant growth.

Fertile: May.

Distribution: CHINA, JAPAN, TAIWAN, HAWAII, INDIA: - South India, Himalayas.

Specimens examined: Jamir 7197 Meluri (Phek dist., 1000 m).

Cyrtomium hookerianum (Prel.) C. Chr., Ind. Fil. Suppl. 1: 101. 1913; et in Amer. Fern J. 20: 44. 1930; Tagawa, Col. Ill. Jap. Pterid. 85. 197. Pl. 28 - 166. 1959; Wang-chueng Shieg in Fl. Taiwan 1: 369. (ed. 2). 1980.

Phanerophlebia hookeriana (Presl.) Copel., Gen. Fil. 3: 1947; Baishya & Rao, Ferns & Fern-allies Meghalaya 131. 1982.

Lastrea hookeriana Presl., Tent. Pterid. 77. 1836.

Polystichum integripinnum Hayata, Icon. Pl. Form. 4: 196, f. 135. 1914.

(Plate 116)

Rhizome short, ascending; roots small, numerous, long spreading. Stipes 20 - 50 x 0.3 - 0.6 cm, erect, rather stout, densely scaly; scales broad, up to 2 x 0.5 cm, dark-brown in the middle, margin pale-brown, lanceolate,

acuminate; lamina 30 - 100 x 8 - 20 cm, simple pinnate, pinnatifid at apex; lateral pinnae 10 - 25 pairs, petiolate, or subsessile, slightly oblique to the rachis; largest pinnae up to 15 x 3 cm, linear-lanceolate, rather falcate, cuneate at base, acuminate at apex, margin entire or undulate; texture coriaceous, or thickly herbaceous, green, glabrous above, pubescent beneath; rachis and costule sparsely covered with small, brown scales and short hairs; veins free, much forked. Sori globose, scattered, submarginal; indusium peltate, orbicular, margin entire or slightly lobed; sporangia slender stalked; spores oval, dark; exine spinulose.

Frequent in dense evergreen forests.

Fertile: October - February.

Distribution: CHINA, TONKIN, JAPAN, TAIWAN, INDIA - Himalayas and Meghalaya.

Specimens examined: Jamir 6580, 6319 Morong forests (Tuensang dist., 2134 m).

7. Pleocnemia

Presl., Tent. Pterid. 183. 1836; C. Chr., Ind. Fil. 498. 1906; Copel., Gen. Fil. 128. 1947.

Terrestrials. Rhizome stout, short-creeping, densely covered with very narrow, long, shining, olive-brown, toothed scales. Stipes erect, rather stout, scaly at base, glabrous above; lamina bipinnate to tripinnatifid, the basal basiscopic pinnules of the basal pinnae much larger than the rest; each sinus with a tooth at base, between the lobes; costae and veins bearing glandular hairs on lower surfaces; veins anastomosing to form costal or costular areolae, other veins free. Sori round, dorsal on veins; indusium reniform, often fugaceous or exindusiate.

A genus of 12 species; 1 in Nagaland.

Pleocnemia conjugata (Blume) Presl., Pr. Epim. 259. 1849; Holttum, Fl. Malaya 2: 534. 1968.

(Plate 117)

Rhizome large, short, stout, usually decumbent, apex densely covered with long, shining, deep-brown, lanceolate scales; scales up to 2.5 x 0.2 cm. Stipes about 50 - 80 x 0.4 - 0.7 cm, erect, rather stout, brown, shining, scaly at base, glabrous above; lamina 50 - 90 x 30 - 60 cm or more, tripinnate, wide spreading, obovate-lanceolate; pinnae

alternate to subopposite, petiolate, the lowest basal pair somewhat shortened than the next above; largest pinna 45 x 20 cm, consisting of 12 - 20 pairs of free pinnules alternate on each side of costa; pinnule up to 10 x 2.5 cm, oblanceolate, sessile, almost at right angles to the costa, the base truncate to broadly rounded, margin deeply cut down nearly reaching the costules, acuminate at apex and toothed; lobes up to 0.6 cm wide at base, slightly oblique, separated by a narrow sinus, oblong, sinuses short, narrow with a few teeth; texture subcoriaceous, brown olivaceous; rachis pale-brown, glabrous or often sparsely covered with very narrow scales beneath, hairy above; costule and veins bearing oblong, unicellular, yellowish glandular hairs beneath, fronds otherwise glabrous; veins free, 1- 3 forked, distinct on both surfaces. Sori dorsal, medial on the veins, about 1/2 way between the costule and the margin of the lobe; indusia persistent, brown, glabrous, folded when sporangia fully matured; spores with winged perispore, wings anastomosing.

Rare; collected only once from a partially shaded locality in a forest at low land.

Fertile: February.

Distribution: MALAYA, SINGAPORE, SUMATRA, BORNEA, PHILIPPINES, BURMA, INDIA - North-east India.

Specimens examined: Jamir 7028 Changki Tzulu (Mokokchung dist., 250 m).

8. Ctenitopsis

Ching ex Tardiev. & C. Chr. Notul. Syst. (Paris) 7: 86. 1938; Copel., Gen. Fil. 123. 1947.

Terrestrial ferns. Rhizome short, erect, stout; roots wide spreading; stipes long, tufted, densely covered with scales at base and sparsely above; lamina bipinnatifid to decompound, apex pinnatifid; lateral pinnae petiolate or sessile; the lowest basal pair somewhat largest, first basiscopic pinnules enlarged; texture thin, herbaceous; rachis, costule, and lamina covered with multicellular ctenitis hairs; veins free, forked, often forming a few areolae without included veinlets. Sori round; indusia round, reniform, attached by sinus, usually all pinnae fertile.

A genus with about 16 species; 1 in Nagaland.

Ctenitopsis fuscipes (Wall.) C. Chr. ex Tard.-Blot & C. Chr. in Not. Sys. 7: 87. 1938; Ching, in Bull. Fan. Mem. Inst. Biol. 8: 313. 1938; DeVol & Kuo, Fl. Taiwan 1: 330. (ed. 2). 1980.

Aspidium fuscipes Wall., List. no. 361. 1827, nom. nud.; ex Bedd., Ferns Brit. India Suppl. 15. Pl. 366. 1876.

Lastrea membranifolia sensu Bedd., Ferns South India 36. Pl. 162. 1863 non Presl.

Tectaria paradoxa (Fee) Sledge in Kew Bull. 27: 413. 1972; Baishya & Rao, Ferns & Fern-allies Meghalaya 135. 1982.

Rhizome short, erect, rather stout. Stipes 35 - 55 cm long, tufted, dark-brown, stramineous, covered with black, linear-lanceolate, acuminate scales; scales about 1.2 x 0.1 cm; lamina 35 - 45 x 15 - 25 cm, bipinnatifid at apex, deltoid to ovate; lateral pinnae 10 - 15 pairs, opposite or subopposite, sessile or petiolate, deeply cut down to the costae; lowest basal pinnae 10 - 30 x 7 - 15 cm, broadly deltoid-ovate, much larger, the first basiscopic lobe enlarged, apical part of the lamina deeply pinnatifid with a decurrent base, the segments about 1 cm wide, obtuse or round at apex, margin entire or bluntly lobed, texture herbaceous, hairy on upper side; fertile lamina more contracted, rachis and costae brownish, sparsely covered by scales and dense ctenitis hairy on the upper side;

veins free or forked, often forming a few areolae without included veinlets; each basiscopic veinlet arising from the costa. Sori scattered, generally terminating on the free veinlets; indusia reniform, suborbicular, margin undulating, glabrous, attached above at base; sporangia stalked, all pinnae soriferous.

Common in moist, shady forests as well as along rivers and streams.

Fertile: October.

Distribution: SRI LANKA, BURMA, VIETNAM, CHINA, TAIWAN, INDIA - Assam, Sikkim and Meghalaya up to 1000 m elevations.

Specimens examined: Jamir 6669 Tijit (Mon dist., 200 m).

9. Tectaria

Cavanilles, Anales de Historia Natural 1: 115. 1799; C. Chr., Ind. Fil. 632. 1906; Copel. , Gen. Fil. 128.1947.

Terrestrial ferns, sometimes growing in rock crevices. Rhizome short-creeping or erect, rather stout; vascular bundles dictyostelic with 2 larger bundles on upper side. Stipes with a ring of vascular bundles, tufted, not articulate to rhizome, covered with dark-brown or blackish, entire, narrowly lanceolate scales at base, lamina pinnate

to bipinnate; basal pinnae larger, basicopic pinnules of lowest pinna often enlarged, texture thin. Stipes, rachis and costae covered with ctenitis hairs on upper side; veins free, forked, often with a series of arched veins along the costa, areolae usually with included, free veinlets Sori round or oval to elongate, borne on the veinlets; indusia round or reniform, attached by its sinus at base, often absent; spores bilateral, with perispore.

A large genus with about 200 species in the world; 8 species in Nagaland.

K E Y T O S P E C I E S

1a. Stipes broadly winged . . . . . vasta

1b. Stipes not winged.

2a. Sori on free veins.

3a. Fronds hairy on the upper surface.

4a. Veins anastomosing in central and costular areoles . . . . . devexa

4b. Veins copiously anastomosing, margin of lamina hairy . . . . macrodonta

3b. Fronds glabrous on the upper surface or with very few hairs . . variolosa

2b. Sori on anastomosing veins.

5a. Fronds 3-foliate to 3-lobed . . polymorpha var. trifida

5b. Fronds pinnate.

6a. Basal pair of pinnae entire . . . heterocarpa

6b. Basal pair of pinnae lobed.

7a. Basal pair of pinnae deeply 2-lobed . . . . . polymorpha

7b. Basal pair of pinnae trifoliate or pinnate . . . . . simonsii

Tectaria devexa (Kuntze) Copel. in Philip. J. Sci. 2C: 415. 1907; Holttum Fl. Malaya 2: 505. 1968; DeVol & Kuo, Fl. Taiwan 1: 341. 1. 121. 1980.

Aspidium devexum Kuntze, Bot. Zeit. 259. 1848.

Aspidum membranaceum Hook. Sp. Fil. 5. 1864.

Pleocnemia membranacea Bedd., Ferns Brit. India Suppl. 15. 1876; et Handb. Ferns Brit. India 225. 1883.

Saginia gigantia var. minor Bedd., Ferns Brit. India t. 243. 1870.

Rhizome short, erect to semierect, more or less densely covered with blackish to dark-brown, glossy, narrowly lanceolate, hair-tipped scales; scales up to 0.5 x 0.1 cm, Stipes 10 - 35 cm long, tufted, slender, dark to pale-brown, sparsely covered with scales throughout. Lamina up to 35 x 20 cm, deltoid, bipinnate to tripinnatifid; lower pinnae 2 - 5 pairs, free, petiolate, opposite to

alternate, upper 1 - 2 pairs adnate or sessile with slightly decurrent bases, delto-acuminate at apex; the lowest pair of pinnae largest, about 15 x 6 cm, deltoid, with enlarged basiscopic pinnule, more or less deeply lobed, margin crenate, the sub-basal pinnae usually pinnate at the base, the rest above deeply lobed with gradually acuminate apex, margin shallowly crenate, texture thin, herbaceous, brownish-green when dry, rachis and costae densely covered with ctenitis hairs on the upper surface, more sparsely beneath, both surface clothed with short erect hairs; veins free, except for a row of costal areolae. Sori up to 0.2 cm wide, rather large, medial or submarginal, borne on ends of free veinlets; indusia round to reniform with ciliate margin; spores brown, slender stalked.

Common in moist, shady places in dense forests; sometimes on rock crevices along the river courses and waterfalls.

Fertile: May - December.

Distribution: SRI LANKA, CHINA, JAVA, MALAYA, PHILIPPINES, POLYNESIA, THAILAND, TAIWAN, INDIA.

Specimens examined: Jamir 6590 Tijit (Mon dist., 100 m).

Tectaria heterocarpa (Baker) Ching in Sinensia 2: 29. 1931.

Aspidium heterosorum Baker in Suppl. P. 46.

Aspidium heterocarpum Bedd., Ferns Brit. India 219. t. 112. 1883.

(Plate 118)

Rhizome long creeping, stout, large, about 1 cm or more across. Stipe up to 60 cm or more long, brownish, solitary, erect, more or less densely covered with brown, linear-lanceolate, persistent scales at base and glabrous above; lamina up to 70 x 30 cm or more, pinnate; lateral pinnae up to 10 pairs or sometimes more, opposite or subopposite, sessile to subsessile, with a single terminal pinna quite similar to lateral ones; areophores or bud-like structure present at the base of each stalk of pinnae; largest pinnae up to 30 x 6 cm, subsessile or very shortly stalked, ovate-lanceolate in outline, rounded to ovate at base, broadest somewhat near the base, gradually narrowed into a long caudate apex, margin usually entire, often slightly undulate, texture thin, herbaceous; rachis and costae pale-brown, glabrous, both surfaces of lamina glabrous, brown to greenish when dry; main lateral veins conspicuous, distinct nearly reaching the margin; aeroles copious, netted with free included veinlets. Sori small, brown, along the scattered netted veins; indusium small, roundish to reniform, or sometimes curved to linear.

Frequent near rivulets and streams in shady forests, sometimes forming large thickets.

Fertile: July - December.

Distribution: BANGLADESH, INDIA - Assam.

Specimens examined: Jamir 7062 Changki/Tzumet (Mokokchung dist., 1000 m).

✓ Tectaria macrodonta (Fee) C. Chr., Ind. Fil. Suppl. 111. 181. 1934; Dhir & Datta in Nova Hedwigia 27: 412. 1976; Dhir, Ferns N.W. Himalayas 78. 1981.

Sagenia macrodonta Fee Gen. Fil. 313. t. 24A, f. 1. 1850-52.

Aspidium cicutarium (Linn.) Sw., Schrad. J. 1800[2]. 36. 1801; Bedd., Handb. Ferns Brit. India 220. 1883.

(Plate 119)

Rhizome short, erect to suberect, apex densely covered with dark-brown, linear-lanceolate, hair-tipped scales; scales up to 1.2 cm long. Stipes 10 - 75 cm long, dark to purplish, densely scaly at base, sparsely above; lamina various in shape and size, usually 20 - 70 x 12 - 40 cm, cordate to deltoid in outline, bipinnate to tripinnate; lateral pinnae 2 - 6 pairs, opposite to alternate; the lowest 1 - 3 pairs shortly stalked, the rest sessile to adnate with a terminal pinnatifid lobe, the lowermost

primary pair of pinnae largest, up to 8 - 40 x 5 - 28 cm, deltoid to oblong in outline, stalked; the secondary pinnae up to 25 x 10 cm, linear-oblong, sessile or very shortly stalked, deeply cut down to $\frac{1}{4}$ - $\frac{1}{2}$ into tertiary pinnae or pinnules; tertiary pinnae about 8 x 3 cm, linear-oblong, sessile or decurrent at base, bluntly acuminate at apex, margin entire to shallowly lobed; texture thin, herbaceous, glabrous or sparsely hairy on the upper surface; costa and costules puberulous or shortly hairy beneath; main lateral vein conspicuous, extended up to margin, others variously and copiously netted, rarely with free included veinlets. Sori up to 0.2 cm wide, arranged in two rows between the main veins, on the netted veins or at the ends of free veinlets; indusia reniform to peltate, brown.

Frequent; usually on moist, moss-covered rocks near rivers and streamlets in shady places.

Fertile: May.

Distribution: MALAYA, INDIA:- throughout the Indian region.

Specimens examined: Jamir 7118, 7122 Changki (Mokokchung dist., 1000 m); 7181 Helipong forests (Tuensang dist., 1371 m); 6661 Mon (Mon dist., 898 m).

✓Tectaria polymorpha (Wall. ex Hook.) Copel., in Philip. J. Sci. 2 C: 413. 1907; Holttum, Fl. Malaya 2: 518. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 136. 1982.

Aspidium polymorphum Wall. ex Hook., Sp. Fil. 4: 54. 1862; Bedd., Ferns South India t. 116, 117. 1863; et Handb. Ferns Brit. India Suppl. 218. 1892.

Nephrodium polymorphum Hook. et Baker, Syn. Fil. 297. 1867; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 537. 1880.

(Plate 120)

Rhizome short, erect or suberect, apex densely clothed with stiff, shining, dark-brown, broad-lanceolate scales; scales about 1 x 0.2 cm, Stipes up to 65 cm long, or more, tufted, erect, slender, scaly at base, glabrous above; lamina up to 60 x 35 cm or more, simple pinnate, large, delto-lanceolate; lateral pinnae up to 6 pairs, opposite or subopposite, sessile or petiolate, often adnate and a single pinna at the apex, which is similar to the lateral ones, sometimes confluent; basal pair pinnae large, petiolate, usually biforked at lower base; largest pinna up to 35 x 10 cm or more, oblong or elliptical, petiolate or subsessile often adnate, narrowly cuneate at the base, acuminate at apex, margin entire or slightly toothed, fertile lamina slightly contracted than sterile ones; costae and costules raised; texture firm, herbaceous, to subcoriaceous; veins

prominent, distinct with many free included, simple or forked veinlets. Sori dorsal on the connecting or netted veins, small, generally round, superficial, scattered all over; indusia long stalked, reniform, firm, brownish, persistent, entire, attached at the base; sporangia long stalked; annulus rather oblique; spores oval, yellow, hyaline; exine smooth.

Very common throughout the state, in moist, shady places in forests; sometimes along roadsides and crevices of rocks. One of the extremely variable species with regard to fronds. This is a lowland species but recorded at higher elevations also.

Fertile: May - December.

Distribution: MALAYA, BURMA, PHILIPPINES, SRI LANKA, Bangladesh, INDIA - Western ghats, Himalayas, Meghalaya and Assam.

Specimens examined: Jamir 6203, 6207, 6208, 6204 Changki (Mokokchung dist., 1000 m); 7186, 7188 Meluri (Phek dist., 1200 m); 6492 Kohima (Kohima dist., 1445 m); 6663 Tijit (Mon dist., 200 m).

Tectaria polymorpha var. trifida var. nov.

(Plate 121)

Rhizome short, erect or suberect, apical part rather densely covered with narrow, stiff, dark-brown, shining, linear-lanceolate scales; scales up to 1.2 x 0.1 cm. Stipes up to 20 - 30 cm long, tufted, erect, slender, pale-purplish, scaly at base, glabrous above; lamina up to 22 x 16 cm, trilobed, the middle lobe largest, ovate-lanceolate, narrowly caudate-acuminate, up to 20 x 6 cm, lateral lobes smaller, subelliptic to lanceolate, cordate at base, gradually tapering into a narrowly caudate-acuminate apex, margin entire or slightly undulate, up to 15 x 5 cm; texture thin, but firm, herbaceous, brownish when dry; costae and costules raised; glabrous on both surfaces of the lamina; veins prominent, distinct, reaching the margin, with regular cross-veins enclosing two rows of areoles with many included, simple or forked, free veinlets. Sori small, dorsal, on the netted veins; round, superficial; indusia reniform; sporangi minutely stalked; spores oval, hyaline; exine smooth.

Extremely rare; collected only once from rock-crevices in a road cutting

Fertile: July.

Distribution: Nagaland.

Specimens examined: Holotype Jamir 6207 Changki (Mokokchung dist., 1000 m) (It is proposed to deposit the Holotype in CAL after the valid publication of this species).

Tectaria simonsii (Baker) Ching in Sinensia 2: 32.f. 13. 1931; Baishya & Rao, Ferns & Fern-allies Meghalaya 136. 1982.

Nephrodium simonsii Baker, Syn. Fil. 504. 1874.

Aspidium simonsii (Baker) Bedd., Ferns Brit. India 218. 1883.

Rhizome up to 3 cm wide, rather massive, stout, erect to semierect, with persistent stipe bases, apical part densely covered with dark-brown, linear lanceolate, hair-tipped scales; scales up to 1 x 0.7 cm. Stipes up to 30 - 70 cm or more long, tufted, glabrous, dark to blackish-purple, shining; lamina up to 40 - 70 x 20 - 40 cm, unipinnate except the lowest basal pair which is bipinnatifid, lowest basal pinnae up to 40 cm long, stalked (stalk about 7 cm long) trifoliate; largest pinnae up to 30 x 15 cm, oblong, elliptic, auricled at base, gradually narrowed into an acuminate apex, deeply lobed towards base, margin irregularly lobed; rachis dark-purplish, glabrous, shining; texture subcoriaceous, dark-brown when dry; veins raised, secondary veins uniting to form two rows of areoles in between each pair of lateral veins, included veinlets absent; costae and main veins more or less densely

setose on both surfaces. Sori small, brown, globose, superficial, irregularly scattered; indusia reniform, fugaceous.

Rare; in shady places along the river banks in dense forests.

Fertile: July.

Distribution: BANGLADESH, BHUTAN, INDIA - Sikkim and Meghalaya.

Specimens examined: Jamir 7185 Meluri (Phek dist., 1000 m).

Tectaria variolosa (Wall. ex Hook.) C. Chr. in Contr. U.S. Nat. Herb. 26: 289. 1931; Holttum, Fl. Malaya 2: 506. 1968; DeVol & Kuo, Fl. Taiwan 1: 346. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 136. 1982.
Aspidium variolosum Wall. ex Hook., Sp. Fil. 4: 51. 1862; Bedd., Ferns Brit. India t. 365. 1870.
Nephrodium variolosum Hook. et Baker, Syn. Fil. 298. 1867; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 538. 1880.

Rhizome stout, short, creeping to suberect; apex densely covered with thin, shining, blackish-brown, narrowly

lanceolate scales; scales up to 0.7 x 0.1 cm. Stipes 25 - 50 cm long, tufted, slender, scaly at base, glabrous above; lamina 20 - 35 x 8 - 15 cm, deltoid in outline, bipinnate at base, pinnatifid at the apex, deeply lobed, more or less decurrent; lateral pinnae 1 - 4 pairs; petiolate, opposite or subopposite; basal pinnae up to 15 x 6 cm, pinnatifid upwards, the basal basiscopic pinnule largest, about 6 x 2 cm, lanceolate, rounded at the base, acuminate at apex, margin more or less deeply lobed; lobes oblong, obtuse or rounded, rachises, costae and costules densely covered with short, brown, septate or ctenitis hairs on the upper side. Fertile fronds usually narrower than sterile ones. Texture firm, herbaceous; veins forming a row of costal areolae and copiously anastomosing up to the margin, many areolae without included veinlets. Sori large, round, terminal on veinlets, often on the netted veins; indusia reniform, round, peltate, brownish, persistent, attached at the base.

Rare; in moist shady forests in lower elevation.

Fertile: May.

Distribution: MALAYA, CHINA, THAILAND, VIETNAM, TAIWAN, INDONESIA, BANGLADESH, INDIA - Sikkim, Assam, Meghalaya.

Specimens examined: Jamir 7165 Chumuketema (Kohima dist., 250 m).

Tectaria vasta (Blume) Copel., in Philip. J. Sci. 2C: 411. 1907.

Aspidium vastum Blume, Enum. Pl. Jav. 142. 1828.

(Plate 122)

Rhizome short-creeping to erect, massive, apex densely covered with stiff, dark-brown, broad-lanceolate scales; scales about 2 x 0.3 cm. Stipes 30 - 50 cm long, tufted or erect, stout, narrowly winged nearly to the base, the wing up to 1 cm wide on either side; lamina up to 90 x 40 cm, deeply cut down to a broadly winged rachis, consisting of 1 - 6 pairs of pinnae; the rachis winged to about 1 - 1.5 cm wide on either side; lowest pinnae about 40 x 10 cm, linear-oblong, decurrent at base, acuminate at apex, margin usually entire, the lowest two pairs with 1 - 2 long lobes on lower side; rachises and costae sparsely scaly beneath; texture somewhat thick, herbaceous, both surfaces naked; main veins clearly distinct, nearly reaching the margin, jointed by numerous prominent cross-veins, forming 6 - 12 areoles between the costa and margin, with netted and free veinlets in the areoles. Sori up to 0.2 cm wide, round, scattered on the netted veins; indusia reniform, brown.

Not common; seen occasionally along rivers and streams.

Fertile: February.

Distribution: MALYA, BANGLADESH, SUMATRA, BURMA AND SIAM, INDIA - Meghalaya, Assam and Sikkim.

Specimens examined: Jamir 7975 Changki Alarimero (Mokokchung dist., 1000 m).

10. Ctenitis

(C. Chr.) Christenson ex Tardiew et Christensen, Notul. Syst. (Paris) 7: 86. 1938; Copel., Gen. Fil. 123. 1947.

Terrestrials. Rhizome short, erect to semierect, rarely creeping, broadly scaly. Fronds bipinnate to decompound, broad at base, herbaceous. Stipes and rachis paleate beneath, palea toothed, hairy above, with multicellular hairs, hairs articulate; veins free, simple or branched. Sori simple to biseriate, dorsal on the veins, indusiate; indusia round to reniform, often absent; annulus of 12 - 16 thickened cells; spores bilateral.

A genus of about 150 species; 2 in Nagaland.

K E Y T O S P E C I E S

Sori confined to the terminal portion of pinnules . . . . . apiciflora

Sori on both sides along the pinnules . . . . . parishii

Ctenitis apiciflora (Wall.) Ching in Bull. Fan. Mem. Inst. Biol. 8: 284. 1938; Mehra & Bir, Pterid.Fl. Darjeeling & Sikkim Himalayas 134. 1964; DeVol & Kuo, Fl. Taiwan 1: 326. (ed.2). 1980.

Aspidium apiciflorum Wall. List. No. 345. 1828 nom. nud.

Dryopteris apiciflora (Wall.) O.Kuntze, Rev. Gen. Pl., 2: 812. 1891.

Nephrodium apiciflorum Clarke in Trans. Linn. Soc. Lond., Ser. 2, (Bot.) 517. 1880.

Lastrea filix-mas var. parallelogramma sub.var. apiciflora Bedd., Handb. Ferns Brit. India 249. 1883.

Lastrea apiciflora (Wall.) Presl., Tent. 76. 1836; Bedd., Ferns Brit. India Pl. 40. 1865.

Rhizome short, erect, rather massive and stout. Stipes up to 20 - 40 cm long, more or less densely covered with blackish-brown to brown, subdeltoid to ovate-lanceolate, entire, hair-tipped scales which measure about 1 x 0.2 cm; lamina about 30 - 80 x 20 - 35 cm, broadly oblong-lanceolate, bipinnate; lateral pinnae 20 - 30 pairs, subopposite or alternate, sessile; the lowest 2- 4 pairs somewhat reduced and slightly deflexed; largest lateral pinnae up to 20 x 4 cm, oblong-lanceolate, widely spreading, sessile, acuminate, deeply cut down up to or nearly to the costa into pinnules or segments; largest pinnules up to 2 x 0.7 cm,

oblong, slightly decurrent at base, rounded at apex, margin entire or slightly crenate towards apex; rachises and costae rather densely clothed with lanceolate, brown scales; rachises with groove on upper side, brown ctenitis hairs present on the upper side of rachillae; dark-greenish to brown when dry; veins distinct on the lower surface of pinnule, forked once or twice, up to the margin, oblique to costa. Sori up to 0.2 cm wide, rather large, confined only to the apex of pinnules, 2- 7 pairs on each side of the costa; indusium pale-brown, peltate or reniform, entire; sporangia shortly stalked, brown; Sori globose, dark-brown; exine spinulose.

Frequent; one of the high altitude ferns prefering dense forest floor.

Fertile: May.

Distribution: NEPAL, CHINA, TAIWAN, INDIA - Darjeeling.

Specimens examined: Jamir 7156, 7141 Pulebadge (Kohima dist., 1600 - 2000 m).

Ctenitis parishii (Hook.) Panigrahi

Nephrodium parishii Hook., Sp. Fil. 4: 131.t.260. 1862.

Lastriopsis parishii (Hook.) Ching in Bull. Fan. Mem. Inst. Biol. Bot. 8: 159.1938; Holttum, Fl. Malayas 2: 498, t. 294. 1968.

Rhizome short-creeping, rather stout, more or less densely covered with brown, glossy, linear-lanceolate to deltoid, narrowly acute scales; scales up to 2 x 0.5 cm. Stipes up to 60 cm or more long, slender, dark to pale-brown when dry, more or less scaly at base, scales similar to rhizome ones; lamina up to 70 x 40 cm or more, subdeltoid in outline, bipinnate (except tripinnate at the base) lateral pinnae up to 10 pairs or more, opposite to alternate, petiolate except 2 - 3 pairs adnate towards apex; the lowest pair of pinnae largest, about 40 x 20 cm, oblong, petiolate about 3 cm long, gradually acuminate at apex; the pinnules on their basiscopic side much enlarged; secondary pinnae up to 12 pairs, alternate, half of the lower pairs of pinnae short-stalked, narrowly acuminate, deeply cut down, more or less very quite to the secondary costae into tertiary pinnae or pinnules, tertiary pinnae up to 3.5 x 1 cm, oblong, acute or round at apex, usually decurrent, rarely the lowest pairs sessile, margin more

or less again deeply lobed; texture thin, translucent; rachis and costae clothed with small, short hairs on both surfaces, short hairy on the upper surface of lamina. Sori small, brown, medial, arranged in two rows on each lobe; indusium small, brownish, reniform, glabrous.

Abundant, on humus soil in dense forests.

Fertile: June - December.

Distribution: MALAYA, SIAM, BURMA, INDIA.

Specimens examined: Jamir 6142 Phek (Phek dist.,1200m); 6085, 6052 Peren (Kohima dist., 1446 m); 7903, 6095 Kohima (Kohima dist., 1445 m).

11. Heterogonium

Presl., Epim. Bot., 142. 1849; Copel., Gen. Fil. 127. 1947.

Terrestrials. Rhizome, erect to semierect, scaly. Stipes tufted, scaly at base or throughout. Fronds deeply bipinnatifid; lowest pinnae largest or not much shorter than the pair above, widened on the basiscopic side or somewhat below the middle, the basal basiscopic lobe short; texture thin, herbaceous, blackish-green when dry; veins free or more usually forming a regular series of costal and costular areoles without included free veins; remaining veins free or areoles with few free included veinlets; upper surface

of lamina with scattered multicellular hairs. Fertile fronds usually narrower than the sterile ones, otherwise similar in venation and hairy. Sori round; indusium reniform or without indusium.

Heterogonium pinnatum (Copel.) Holttum, Sarawak Mus. J. 5: 163. 1949; et Fl. Malaya 2: 524. 1968.
Stenosemia pinnata Copel. in Philip. J. Sci. 1, Suppl. 2: 146. 1906.
Pleocnemia membranifolia pro parte quoad. Bedd., Handb. Ferns Brit. India Suppl. 48. 1892.

Rhizome short, erect, apex densely covered with stiff, black to dark-brown, linear-lanceolate, hair-tipped scales; scales up to 1 cm long. Stipes up to 50 cm long, dark to pale-brown, densely scaly at base, sparsely above; lamina up to 50 x 25 cm or more, deltoid in outline, bipinnate; pinnae numerous, opposite to alternate, the lowest one usually shortly petiolate, about 0.5 cm long, the uppermost adnate or decurrent at base; the lowest pair of pinnae largest, 15 x 5 cm or more, slightly deflexed, more widened at middle and narrowed towards the base on the basiscopic side; the remaining upper pinnae up to 15 x 3 cm, subtruncate to obliquely truncate at base, slightly broadened towards the middle, gradually narrowed into an acuminate apex, fertile smaller than sterile ones; margins of pinnae

deeply cut down 1/3 - 1/2 into lobes; lobes up to 0.3 - 1 cm wide, slightly oblique to falcate, rounded at apex, margin usually entire, often shallowly crenate; texture thin, herbaceous; rachis and costae clothed with short brown hairs; upper surface of sterile pinnae bearing scattered, lax, jointed hairs; rachis, costae, costules and veins usually glabrous or with sparse, lax, jointed hairs on the lower surface; veins usually forked, subequal in sterile pinnae, the acroscopic branch short bearing sori at its end in fertile pinnae. Sori up to 0.2 cm wide, large, brown, round; indusia reniform, rather large, brownish, thin, margin entire, glabrous.

Frequent in moist, shady forests near river banks and slopes of hills.

Fertile: October.

Distribution: SUMATRA, BORNEO, MALAYA, PHILIPPINES, INDIA.

Specimens examined: Jamir 6590,6561 Bakalabar/Chumuketema (Kohima dist., 250 m).

33. LOMARIOPSIDACEAE

Terrestrials, usually creeping on rocks, Rhizome creeping or ascending dorsiventrally, rooting on ventral side. Stipes distant or tufted, not articulate to rhizome; upper surface one or two grooved, with several vascular bundles in the stele; scales brown, ovate-lanceolate, peltately attached near the base. Fronds dimorphic, simple or pinnate, veins free, simple or once forked or anastomosing, forming areolae with or without included veinlets. Fertile fronds much contracted, with usually longer stipes, lamina narrower than those of the sterile fronds. Sporangia

stalked, acrostichoid, dehiscing by transverse slits; paraphyses absent; annulus of 10 - 20 thickened cells, spores bilateral, monolete, exine smooth.

A family of 8 genera; 2 genera represented in Nagaland.

K E Y T O G E N E R A

Veins free . . . . . Egenolfia
Veins anastomosing . . . . . Bolbitis

Egenolfia

Schott, Gen. Fil. t. 16. 1834; Copel. Gen. Fil. 116. 1947.

Rhizome short-creeping on rocks, dorsiventral, dictyostelic in organisation, clothed with brown, clavate scales. Stipes stramineous, sparsely scaly with many vascular bundles. Fronds simple pinnate, dimorphic; sterile fronds more or less crenate-lobed, with a prominent tooth in each sinus; veins free, often forming a partial row of costal areolae; stipes of sterile fronds usually longer, pinnae smaller; sporangia acrostichoid.

A genus with about 10 species; 1 in Nagaland.

√Egenolfia appendiculata (Willd.) J. Smith, Ferns Brit. For. 111. 1880; Holttum, Fl. Malaya 2: 459. 1968; DeVol in Fl. Taiwan 1: 350. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 121. 1982.

Acrostichum appendiculatum Willd., Sp. Pl. 5: 114. 1810; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 577. 1880.

Polybotrya appendiculata sensu Bedd., Handb. Ferns Brit. India 425. 1883.

Bolbitis appendiculata (Willd.) K. Iwat., in Acta Phytotax. Geobot. 18: 48. 1959; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 184. 1975.

(Plate 123)

Rhizome short-creeping, up to 7 x 0.5 cm, apex covered with narrow, blackish-brown, lanceolate-acuminate scales; scales about 0.5 cm long. Stipes 9 - 35 x 0.1 - 0.4 cm, tufted, slender, pale-green, sparsely covered with scales; scales similar to those on the rhizome; rachis and costae stramineous, scaly. Fronds simple pinnate, dimorphic; sterile lamina 20 - 40 x 5 - 15 cm, pinnatifid at apex, with about 18 - 30 pairs of pinnae, arranged at right angles to the rachis, apex usually with a bud near the tip; pinnae 2 - 6 x 0.7 - 2 cm, subsessile to sessile, subopposite or alternate, oblong-lanceolate, truncate and auricled at base, apex rounded or rarely acute; lower margin entire, upper margin crenate-lobed with a sharp tooth in each sinus,

auricled near base; veins free, forked twice or thrice, veins on both surfaces not prominent. Texture thin but firm; fertile lamina 12 - 30 x 2 - 4.5 cm; pinnae 0.5 - 2.2 x 0.3 - 0.8 cm, oval-ovate; apex oblong-rounded, cuneate and auricled at base, edges slightly crenate, with short sinus teeth; stipes of fertile fronds longer than those of sterile ones; sporangia blackish-brown, entirely covering the lower surface.

Very common on moist, shady rocks covered by humus soil along the river courses in forests.

Fertile: October - February.

Distribution: MALAYSIA, THAILAND, INDONESIA, TAIWAN, SIAM, PHILIPPINES, HONGKONG, INDIA - Common throughout the Indian region.

Specimens examined: Jamir 6657 Mon (Mon dist., 898 m); 7964 Changki alarimeso (Mokokchung dist., 1000 m).

Bolbitis

Schott, Gen. Fil. t. 14. 1834; Nayar & Kaur, in Bull. Natl. Bot. Gdns. no. 88. 3. 1964.

Rhizome creeping or ascending, dorsiventral. Stipes distant or tufted, not articulate to rhizome, brown, scaly at base. Fronds dimorphic; fertile and sterile fronds separate; simple or pinnate; veins simple or once forked, areoles along costa and costules, excurrent veinlets present. Sporangia at first along veins, later becoming acrostichoid; annulus of 10 - 20 thickened cells; spores bilateral; exine smooth.

Very close to Egenolfia Schott., but differs in having anastomosing veins.

A large genus of 185 species; 4 in Nagaland.

K E Y T O S P E C I E S

1a. Pinnae lobed or dentate.

2a. Terminal portion of fronds with a proliferating bud; pinnae shallowly lobed with a tooth in each sinus; not climbing . . bipinnatifida

2b. Terminal portion of fronds not with such proliferating buds;

pinnae crenate to irregularly dentate; climbing ferns . . . . . nagalandense

1b. Pinnae entire or nearly so.

3a. Lamina trifoliate to pinnate with a vegetative bud at the end; pinnae subopposite; fertile lamina 1.5 - 2.2 cm wide . . . . . heteroclita

3b. Lamina pinnate, without such terminal pinnae; pinnae alternate; fertile lamina 0.3 - 0.5 cm wide . . . virens

Bolbitis bipinnatifida (J. Smith) K.Iwats. in Acta Phytotax. Geobot. 18: 49. 1959; Baishya & Rao, Ferns & Fern-allies Meghalaya 121. 1982.

Egenolfia bipinnatifida J. Smith, Hist. Fil. 132.1875.

Acrostichum appendiculatum var. costulata Hook., Sp. Fil. 5: 252. 1864.

Polybotrya appendiculata var. costulata (Hook.) Bedd., Handb. Ferns Brit. India 426. t. 257. 1883.

(Plate 124)

Rhizome thick, short-creeping, up to 1 cm across, densely covered with scales; scales up to 0.6 x 0.2 cm, linear, broad-acuminate, dark to pale-brown. Stipes 8 - 55 x 0.2 - 0.5 cm, erect, pale-greenish, sparsely covered with scales; stipes of fertile fronds longer than those

of sterile ones; fronds simple pinnate, dimorphic; sterile lamina 22 - 70 x 10 - 25 cm, pinnate with about 20 - 30 pairs of pinnae, arranged at right angles to the rachis, suddenly shortened from middle towards apex, usually ending with a vegetative bud at tip; basal pinnae 5 - 20 x 2.5 - 5.5 cm, deeply pinnatifid, often bipinnate, lanceolate, sessile or subsessile, margin deeply serrate or lobed, each lobe crenate; rachis and costae with cordate, peltate scales, more or less winged upwards. Veins reticulate, one pair of basal veins from adjacent costules anastomosing above the sinus, without free included veinlets. Fertile lamina 10 - 30 x 3 - 10 cm, simple pinnate, basal pinnae 1.5 - 5 x 0.4 - 1.5 cm, entire, linear, oblong to lanceolate, cuneate and auricled at base; sporangia blackish-brown, entirely covering the lower surface except the main costae.

Very common in moist, shady places along river banks in forests; often on moss-covered rocks near streams.

Fertile: July - November.

Distribution: BURMA, INDIA - Deccan, Meghalaya.

Specimens examined: Jamir 7958, 7080, 6277 Changki (Mokokchung dist., 1000 m); 6061 Peren (Kohima dist., 1446 m).

Bolbitis heteroclita (Presl.) Ching in C. Chr. Ind. Fil. Suppl. 3: 48. 1934; Holttum, Fl. Malaya 2: 462.1968; DeVol & Kuo, in Fl. Taiwan 1: 348 (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 121. 1982.

Acrostichum heteroclitum Presl., Rel. Haenk. 1: 15. t. 2. f. 2, 1885.

Leptochilus heteroclitus (Presl.) C. Chr., Ind. Fil. 11. 1906.

(Plate 125)

Rhizome up to 1 cm across, long-creeping,often climbing on trees; apex clothed with narrow, lanceolate, dark-brown, clathrate scales; scales up to 0.6 cm long, edges paler. Stipes up to 6 - 35 x 0.2 - 0.4 cm, green to pale-green, sparsely covered by scales throughout; stipes of fertile fronds rather longer than those of sterile ones. Fronds simple or usually with 1 - 4 pairs of variable, simple to pinnate pinnae; pinnae usually trifoliate, rarely 4- pairs of lateral pinnules; apical pinnae 30 x 7 cm, usually extended to a long, narrowly linear, caudate prolongation, about 10 - 30 x 0.3 - 1 cm, bearing a vegetative bud at apex; lateral pinnae 5 - 18 x 2 - 5 cm, ovate-lanceolate, glabrous, lowest shortly stalked, otherwise sessile, broadly cuneate at base, apex acuminate, margin entire to undulate; texture thin, rachis and costae prominent on lower surface with many appressed scales.

Veins prominent, lateral veins raised, secondary veins anastomosing without included veinlets, marginal veins free. Fertile lamina simple or with 1 - 4 pairs of lateral pinnae similar to that of sterile ones, much contracted; apical pinna up to 15 x 2.5 cm, lowest lateral pinna up to 8 x 1.5 cm, short stalked, lanceolate. Sori covering the whole lower surface, brown.

Very common, throughout the state, specially near streams and river banks and also on rocks and rock crevices covered by humus soils. The sterile fronds often proliferate by the apical vegetative buds.

Fertile: May - June.

Distribution: SOUTH CHINA, TAIWAN, MALAYSIA, NEW GUINEA, INDIA - North Eastern Himalayas, Meghalaya.

Specimens examined: Jamir 6674 Tijit, 6619 Mon (Mon dist., 898 m); 6173 Changki (Mokokchung dist., 1000 m).

Bolbitis nagalandense, sp. nov.

(Plate 126)

Rhizome up to 1 cm thick, long creeping, the apical part covered with dark-brown, ovate-lanceolate scales, about 0.5 cm long. Stipes up to 15 - 25 cm long, 6 - 10 cm apart, sparsely scaly throughout similar to rhizome scales, stramineous, pale-greenish when dry, to about 10 - 20 cm

long in sterile fronds. and to 20 - 30 cm long in fertile fronds. Lamina of sterile frond up to 60 x 20 cm, obovate-lanceolate in outline, simple pinnate; lateral pinnae numerous, up to 25 or more pairs, alternately arranged on costa, subsessile or very shortly stalked; the lowest pair not reduced; largest pinnae up to 8 - 13 x 1.5 - 2.5 cm, obovate-lanceolate, subtruncate at base, slightly unequal on the acroscopic side, gradually tapering towards apex, blunt at apex, margin crenate or dentate; texture thin, herbaceous, dark-greenish when dry; rachises pale-brown, stramineous, sparsely scaly, costa 1 - 2.5 cm apart, short scaly beneath, glabrous above, lamina glabrous on both surfaces; veins distinct, forming regular series of areoles without included veinlets, free at the margin. Lamina of the fertile fronds up to 30 x 8 cm, simple pinnate, up to 15 pairs, subopposite or alternate, sessile or subsessile, largest lateral pinnae up to 5 x 0.7 cm, linear ovate-lanceolate, slightly falcate, gradually tapering into an acuminate apex, margin entire; veins similar to sterile fronds but much closer; sporangia dark-brown, densely covering the entire lower surface at maturity.

Rare, in moist shady places along river banks creeping on rocks and also climbing on tree trunks up to 3 m or even more in desne evergreen forests.

Fertile: May.

Distribution: Nagaland.

Specimens examined: HOLOTYPE Jamir 7112,A Changki/ Alarimeru (Mokokchung dist., 1000 m); ISOTYPE 7112,B (NEHU). (It is proposed to deposit the Holotype in CAL after the valid publication).

This species is quite remarkable on account of its climbing habit and very distantly placed stipes on the rhizome.

✓Bolbitis virens (Wall.) Schott, Gen. ad. t. 14, 1934; Holttum, Fl. Malaya 2: 468. 1968; Dhir, Ferns N.W. Himalayas 79. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 122. 1982.

Acrostichum virens Wall. ex Hook. et Grev., Icon. Fil. t. 221. 1831; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 581. 1880.

Leptochilus virens (Wall. ex Hook. et Grev.) C. Chr., Ind. Fil. 20. 1906.

Gymnopteris contaminens (Wall.) Bedd., Handb. Ferns Brit. India 435, t. 264. 1883.

(Plate 127)

Rhizome thick, rather stout, short-creeping, up to 1.3 cm across, scaly at apex; scales up to 0.5 x 0.1 cm, thick, lanceolate-acuminate, large, clathrate, subentire, dull-brown. Stipes 18 - 45 x 0.2 - 0.8 cm, erect, purplish

or pale, sparsely covered with scales throughout; stipes of fertile fronds somewhat longer than those of sterile ones. Fronds unipinnate, dimorphic; sterile lamina 20 - 70 x 10 - 35 cm, with 8 - 20 pairs of lateral pinnae, glabrous; lateral pinnae 8 - 20 x 1 - 3.5 cm, lanceolate; lower stalked, upper sessile, opposite to alternate, slightly oblique to cuneate at base, shortly acuminate; margin cartilagenous and crisped, slightly crenate towards apex, glabrous, upper surface shining, glossy green, lower surface dark-green; texture chartaceous to subcoriaceous; midrib reddish to pale-purplish, slightly raised from the costae, veinlets uniting with opposite veinlets from adjacent costules, veins free at margins, Fertile lamina 15 - 50 x 6 - 20 cm , unipinnate; pinnae 5 - 18 x 0.3 - 1.2 cm, narrowly linear, venation similar to that of sterile lamina but more closer, margins crisped, somewhat reflexed. Sori brownish, entirely covering the lower surface, except on the costae.

Frequent, grows near river banks and on rocks near streamlets.

Fertile: May - July.

Distribution: BURMA, SRI LANKA, JAVA, BANGLADESH, SUMATRA, MALAYA, INDIA - Himalayas, Sikkim, South India up to 1,220 m elevation.

Specimens examined: Samir 6047 Peren, Embai forest (Kohima dist., 1446 m); 7200 Meluri (Phek dist., 1000 m).

34. ELAPHOGLOSSACEAE

Epiphytes. Rhizome thick, stout, creeping, densely scaly, roots fibrous, covered with dark-brown ramenta. Stipes jointed on the rhizome, stipes of fertile fronds longer than those of sterile fronds. Fronds simple, thick, leathery, entire, dimorphous, lamina with small, dark-brown, stellate palae on the ventral surface, texture coriaceous, callous; veins free or uniting together near the margin, simple or forked, usually springing from the midrib at a wide angle; fertile fronds much smaller, and narrower, whole lower surface completely covered by dark-brown sporangia, mixed with short hairs. Spores with perispore.

A family of 3 genera; 1 in Nagaland.

Elaphoglossum

Schott, Gen. Fil. ad. tab. 14. 1834; C. Chr., Ind. Fil. 302. 1906; Copel., Gen. Fil. 116. 1947.

Epiphytes. Rhizome stout, creeping, densely covered by scales; roots spreading, covered with dark-brown ramenta. Stipes articulate on the rhizome. Fronds simple, leathery, entire, dimorphous; lamina with small, dark-brown, stellate palae on the ventral surface; texture coriaceous; veins free or uniting together near the margin, simple or forked;

fertile fronds much smaller and narrower; whole lower surface covered by dark-brown, sporangia; spores round, translucent, small.

A very large genus of 400 species; 1 in Nagaland.

Elaphoglossum yunnanense (Baker) C. Chr., in Contr. U.S. Nat. Herb. 26: 327. 1931.

Acrostichum yunnanense Baker in Kew Bull. 1898: 233. 1898; Holttum, Fl. Malaya 2: 455. 1968.

Elaphoglossum viscosum Sw., Syn. Fil. 193. 1806; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 577. 1880; Bedd., Handb. Ferns Brit. India Suppl. 420. 1892.

(Plate 128)

Rhizome 0.3 - 0.5 cm thick, creeping, densely covered with scales. Stipes 2-ranked, 1 cm apart, scales up to 0.5 cm long, shining, dark-brown, narrow; stipes of sterile fronds up to 20 cm long and those of fertile 25 cm long, young stipes densely covered by stellate, dark-brown scales; sterile fronds up to 50 x 4 cm, gradually narrowed at both ends; texture thin but firm, veins distinct on the lower surface; lower surface more or less persistently stellate scaly; upper surface less densely scaly; mature fronds naked, except for the midrib and edges; fertile fronds up to 35 x 3 cm. Sori acrostichoid; sporangia mixed with short hairs; spores globose, hyaline, perispore present.

Very common in certain restricted localities in dense natural forests.

Fertile: May - July.

Distribution: SOUTH WEST CHINA, MALAYA, INDIA - Meghalaya.

Specimens examined: Jamir 7212 Changki (Mokokchung dist., 1000 m); 7140 Kohima (Kohima dist., 1445 m).

35. NEPHROLEPIDACEAE

Terrestrials or epiphytes. Rhizome short, erect, bearing long, lateral branches (runners) which develop into new plants; roots numerous, fibrous; rhizome scales thin, pale-brown, bearing fine, hairy apex. Stipes tufted; stipe scales similar to those of rhizome scales but sparser; vascular bundles in stipe 'U'-shaped. Fronds long, pinnate, usually closely placed, pinnae falcate, gradually shortened at the base, the lowest ones reduced and sparser; apical lamina also reduced, small, sessile, articulate to rachis, veins free, forked once or more than once. Sori round, terminal on the veins, dorsal or marginal; indusia round or reniform, often with a narrow sinus; sporangia numerous; annulus conspicuous, vertical; spores brown, translucent, bilateral.

A small family with 4 genera; 1 in Nagaland.

Nephrolepis

Schott, Gen. Fil. t. 3. 1834; C. Chr., Ind. Fil. 453. 1906; Copel., Gen. Fil. 90. 1947.

Terrestrials or epiphytes. Rhizome short, erect, covered by thin, pale-brown scales. Stipes tufted. Fronds long, pinnate, pinnae sessile articulate to rachis; veins free, forked once or twice, ending in marginal hydathodes. Sori round, dorsal, marginal; indusia round or reniform; spores brown, translucent, bilateral.

Species about 30; 2 in Nagaland.

K E Y T O S P E C I E S

Leaflets minutely stalked, 7 - 15 cm long, placed 1 - 2 cm apart on the rachis . . . . . biserrata

Leaflets sessile, up to 5 cm long, overlapping . . . . . cordifolia

Nephrolepis biserrata (Sw.) Schott, Gen. Fil. Pl. 3. 1834; Holttum, Fl. Malaya 2: 380. 1968; DeVol Fl. Taiwan 1: 322. (ed. 2). 1980;
Aspidium biserratum Sw., Schrad. J. 2: 32. 1801.
Nephrolepis acuta Bedd., Handb. Ferns Brit. India 284. 1883.

(Plate 129)

Rhizome 8 - 15 cm long, short, erect, densely scaly; scales copious, narrow, thin, shining, dark-brown, linear, hair-pointed, 0.1 - 0.9 cm long, stolens long with numerous roots. Stipes 15 - 30 x 0.5 - 0.7 cm, tufted, erect, stout, usually glabrous except at base; shining olive-brown when dry, clothed with scales like those of the rhizome, but smaller, rachis sparsely scaly. Lamina 100 - 200 x 1.5 - 2.5 cm, pinnate; pinnae 7 - 15 x 1.5 - 2.5 cm, lanceolate, acuminate at apex, truncate or rounded at base; sterile pinnae wider than fertile ones; basal pinnae gradually shortened and more widely spaced; margin serrate or crenate, costa hardly falcate, apex acuminate, surface bearing small scales; veins free, forked once or twice, ending in hydathodes near margin on the upper surface; rachis shining brown, glabrous, sparsely scaly. Sori round, in a single submarginal row; indusia round with a narrow sinus; spores brownish, translucent.

Not common; in plains at open places, sometimes on rock crevices in bamboo forests at lower elevations.

Fertile: February.

Distribution: MALAYA, TAIWAN, SRI LANKA, BANGLADESH, PHILIPPINES, TROPICAL AFRICA, INDIA - North Arcot Hills, North India and North Eastern India.

Specimens examined: Jamir 7030 Changki (Mokokchung dist., 1000 m).

✓Nephrolepis cordifolia (Linn.) Presl., Tnet. Pterid. 79. 1836; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 540. 1880; Bedd., Handb. Ferns Brit. India Suppl. 282, t. 144. 1892; Holttum, Fl. Malaya 2: 379.1968; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 180. 1975; Baishya & Rao, Ferns & Fern-allies Meghalaya 105. 1982.

Polypodium cordifolium Linn., Sp. Pl. 1089. 1753.

(Plate 130)

Rhizome 1 - 10 cm long, short, erect, densely clothed with thin, yellowish-brown, entire, linear, hair-pointed scales; scales up to 0.8 cm long; stolon long, spreading, usually bearing tubers; tubers 0.5 - 2.5 cm long, of various shapes and sizes. Stipes 5 - 15 x 0.1 - 0.4 cm, tough, shining, dark-olive brown when dry, clothed with scales; stipe scales smaller than those of rhizome scales. Lamina 20 - 80 x 4 - 10 cm, simple pinnate, linear-lanceolate,

horizontally spreading; rachis grooved with small, dark-brown scales; pinnae 1.5 - 4.5 x 0.5 - 1 cm, close set, sessile, unequally lobed at base, auricle acute, articulate to rachis, both surfaces glabrescent, margin serrulate; lower pinnae reduced, usually sterile, oblong or obtuse, subcordately lobed at base; upper pinnae serrulate to crenate; overlapping the rachis on the ventral surface; veins simple or once forked, ending in conspicuous hydathodes on both surfaces. Sori round, arranged in a single, sub-marginal row; indusium reniform, oblique to the veins, free the free edges of indusium facing the apex of the pinnae; spores brown, translucent.

Very common; in open places on the mountainous regions. Either terrestrial or epiphytes. In Nagaland mostly noted on palms. Frequently seen on rock crevices in shady places; also cultivated as an ornamental pot herb.

Some local people chew the washed tubers of this fern for sinus trouble, toothache and also for diseases of liver.

Fertile: July - October.

Distribution: TROPICS OF THE WORLD, JAPAN, NEW ZEALAND, MALAYA, TAIWAN, INDIA - throughout the region up to 1525 m elevation.

Specimens examined: Jamir 6043 Dimapur (Kohima dist., 250 m); 6050 Mon (Mon dist., 898 m).

36. OLEANDRACEAE

Terrestrials, rarely epiphytes. Rhizome short, scandent, climbing or ascending, dictyostelic, densely covered with imbricating scales. Stipes tufted or distant with 3-vascular bundles. Fronds articulate to rhizome or with pinnae articulate to rachis; lamina simple or pinnately compound, venation free, parallel with forked veinlets which end in submarginal hydathoes; some fronds often suppressed. Sori round, superficial, in a single row on either side of the midrib, terminal on the veinlets, circular, protected individually by basally attached, reniform indusia; sporangia long stalked; annulus incomplete, interrupted with 12 - 16 indurated cells; spores monolete or bilateral, usually with a distinct, loose perine or with perine not clearly differentiated; the perine as well as exine sometimes spinulose.

Only genus, Oleandra Cav.

Oleandra

Cav., Ann. Hist. Nat. 1: 115. 1799; C. Chr., Ind. Fil. 466, 1906; Copel., Gen. Fil. 90. 1947.

Characters of the family.

A genus of about 40 species; 1 in Nagaland.

Oleandra wallichii (Hook.) Presl., Tent. Pterid. 78. 1836; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 542. 1880; Bedd., Handb. Ferns Brit. India Suppl. 287, t. 147. 1892; DeVol, Fl. Taiwan 1: 322. (ed.2). 1980.

Aspidium wallichianum Hook., Exot. Pl. 1: t. 5, 1823.

(Plate 131)

Rhizome 0.2 - 0.5 cm across, long creeping, scandent; scales dense, 0.2 - 0.5 cm long, lanceolate, hair-tipped, light brown with a dark basal region, subulate or linear, crisped, ferruginous, spreading and often reflexed, thickly tufted at the extremities of the rhizome. Stipes 2 - 5 cm long, paleaceous, jointed close to the base so that lower articulation is concealated among the scales. Fronds 20 - 35 x 3 - 4 cm, oblong, base obtuse or rounded, suddenly narrowed to a caudate apex or acuminate, membranous, midrib prominent; veins free, forked near base, parallel from costa to margin; pubescent along veins on the ventral surface; costa sparingly pubescent with lanceolate scales. Sori round, in a single row on either side of costa, nearly touching costa; indusia reniform, ciliate, membranous, annulus of 13-cells; spores oval, bright brown, hyaline, exine spinulose.

Not common; in moist, dense forests, sometimes among rock crevices and decayed tree trunks covered by moss.

Fertile: August - December.

Distribution: NEPAL, BURMA, CHINA, TAIWAN, BHUTAN, MALAYA PENINSULA, INDIA - North India from Simla to Kumaon, Assam, Meghalaya.

Specimens examined: Jamir 7916 Kohima (Kohima dist., 1445 m); 6332 Shamator (Tuensang dist., 1372 m).

37. DAVALLIACEAE

Epiphytes or terrestrials. Rhizome long-creeping, fleshy, covered with peltate scales. Stipes glabrous, jointed to the rhizome, with several vascular strands (in Leucostegia a pair of broad vascular strands); lamina simple or pinnately decompound, usually deltoid in outline; ultimate leaflets nearly always unequal at the bases which are decurrent on the rachis; veins free, reticulate. Sori terminal on the lamina, submarginal or superficial, round to oblong, discrete; indusia half cup-shaped, tubular, linear, round or reniform, rarely adherent at the base; opening towards margins; sporangia long stalked, with three cells thick at the capsule base; annulus of 10 - 16 thickened cells; spores monolete, perineless; exine surface densely verrucate or tuberculate.

A family of 10 genera; 5 in Nagaland.

KEY TO GENERA

1a. Rhizome clothed by both scales and hairs . . . . . 1. Leucostegia

1b. Rhizome clothed by scales only.

2a. Indusium absent . . . . . 5. Gymnogrammitis

2b. Indusium conspicuous.

3a. Fronds large, much dissected, texture thin . . . . . 2. Araiostegia

3b, Fronds various, texture coriaceous or fleshy.

4a. Indusium tubular, attached at base and side . . . . . 4. Davallia

4b. Indusium scale-like, attached at base only . . . . . 3. Humata

1. Leucostegia

Presl., Tent. Pterid. 94, t. 4. f. 11. 1836; Copel., Gen. Fil. 86. 1947.

Terrestrials. Rhizome fleshy, wide-creeping, densely clothed with long, brown hairs and small, short, thin, brown, lanceolate scales. Stipes articulate to rhizome, slender, erect, glabrous, distant, pale (bearing short hairs and scales when young); lamina glabrous, large, deltoid, tripinnate to decompound; rachis and costae grooved on the upper surface, texture thinly coriaceous; veins forked; free. Sori

globose, submarginal, impressed on both surfaces, terminal on veins; indusia thin, coriaceous, semicircular or ovate, attached by a narrow base, or with basal part cup-shaped; sporangia long stalked; spores hyaline, bilateral, pale, warty.

A genus of 2 species; 1 in Nagaland.

Leucostegia immersa (Wall.) Presl., Tent. Pterid. 95. 1836; Bedd., Handb., Ferns Brit. India 51. 1883; Holttum in Gard. Bull. SS. 9: 131. 1937; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 179. 1975; DeVol & T. Yang in Fl. Taiwan 1: 279. (ed.2). 1980; Dhir, Ferns N.W. Himalayas 58. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 103. 1982.

Davallia immersa Wall. Cat. No. 256. 1828 (nom.nud.) ex Hook., Sp. Fil. 1: 156. 1846; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 443. 1880.

(Plate 132)

Rhizome about 0.4 - 0.6 cm thick, slender, long-creeping, erect, covered with brown, entire, lanceolate scales; scales about 0.4 x 0.1 cm, accompanied by numerous, brownish hairs. Stipes 10 - 30 x 0.2 - 0.5 cm, pale, dark-glossy, shining, glabrous; lamina 15 - 40 x 6 - 25 cm, broadly deltoid to triangular in outline, quadripinnate at base, tripinnate above, glabrous; pinnae and pinnules rather narrowly deltoid,

alternate, the lowest pinnule 7 x 5 cm, deltoid-lanceolate, deeply cut down to the costae with broad segments, which are obliquely truncate at the base, apex blunt lobed, the lobes again crenate above, about 1.5 cm long; texture thin, herbaceous, glabrous; veins forked once or twice, with one vein ending to each tooth or crenated in sterile leaflets, slightly raised on the surfaces. Sori large, terminal on acroscopic veinlet, impressed; indusia whitish-yellow, subcircular, usually wider than long, attached by the narrow base only, fugaceous, opening towards apex, usually not reaching the edge of the lamina; annulus of 13 indurated cells; spores oblong, or reniform, yellow, exine smooth.

Very common on moss-covered, moist soils and also grows on tree trunks and rocks in shady forests.

Fertile: June - September.

Distribution: CHINA, TAIWAN, PHILIPPINES, INDONESIA, MALAYA, BHUTAN, JAVA, INDIA - South India, Western ghats, Himalayas up to 915 - 1820 m; Meghalaya.

Specimens examined: Jamir 6232 Changki (Mokokchung dist., 1000 m); 7919 Kohima peak (Kohima dist., 1445 m).

2. Araiostegia

Copel. in Philip. J. Sci. 34: 240. 1927 (nom. cons.); et Gen. Fil. 85. 1947.

Epiphytes, often growing on moss-covered rocks. Rhizome wide-creeping, fleshy, densely covered with thin, lanceolate scales with a ring of 8 - 12 vascular bundles, 2 or more larger and 10 smaller bundles. Stipes articulate to the rhizome, glabrous; lamina tripinnate, deltoid; pinnae finely dissected; segments clefted into two oblique, elliptic lobes; texture thin. Sori small, globose to subglobose, submarginal, terminal on veinlets; indusia thin, small, round to subdeltoid, attached at base only.

A genus of 12 species; 5 in Nagaland.

K E Y T O S P E C I E S

1a. Scales adpressed to rhizome, mostly peltate.

2a. Indusium cordate-acute. . . . . delavayi

2b. Indusium hemispherical or subreniform.

3a. Spores tuberculate . . . . . pulchra

3b. Spores smooth . . . . . hymenophylloides

1b. Scales not adpressed to rhizome, peltate or basally fixed.

4a. Leaves bipinnatifid; indusium not cordate at base . . . . . membranulosa

4b. Leaves bipinnate; indusium cordate at base . . . . . multidentata

Araiostegia delavayi (Bedd. ex Clarke et Baker) Ching in Chien et Chun, Fl. Reipubl. Pop. Sin. 2: 289. 1959; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 178. 1975; Dhir, Ferns N.W. Himalayas 57. 1980.

Davallia delavayi Bedd. ex Clarke et Baker J. Linn. Soc. 24: 410. 1888.

Davallia beddomei Hope in J. Bomb. nat. Hist. Soc. 12: 527. 1899; Baisya & Rao, Ferns & Fern-allies Meghalaya 99. 1982.

Rhizome creeping, covered with pale-brown scales and whitish hairs. Stipes 7 - 20 cm long, glabrous above and covered with membrane-like, pale-brown, peltate scales at base; lamina 12 - 35 x 7 - 20 cm, tripinnate, deltoid-lanceolate, coriaceous, the lowest basal pinnae about 12 x 5 cm, petiolate; petiole about 0.5 cm long; upper pinnae sessile, alternate or subalternate, narrowly dissected to the rachis giving winged appearance to rachis; segments with clefted apex; veins prominent. Sori at the joints of

the clefted apex; indusia membranous, cordate-acute, margins entire; spores bean-shaped, pale-yellowish.

Rare; on moist tree trunks in dense evergreen forests.

Fertile: May - September.

Distribution: N.E. INDIA.

Specimens examined: Jamir 7210 Changki (Mokokchung dist., 1000 m).

Araiostegia hymenophylloides (Blume) Copel. in Philip. J. Sci. 34: 241. 1927; Holttum, Fl. Malaya 2: 363. 1954; Baishya & Rao, Ferns & Fern-allies Meghalaya 99. 1982. Aspidium hymenophylloides Blume, Enum. Pl. Jav. 172. 1828. Leucostegia hymenophylloides Bedd., Ferns Brit. India Correction 4. 1876; et Handb. Ferns Brit. India 54. 1883. Davallia affinis Hook., Sp. Fil. 1: 58, t. 52B, 1846; Bedd., Ferns South India t. 252. 1863.

Rhizome creeping, thick, densely clothed with broad, pale-brown, entire, peltate scales; scales about 0.4 x 0.2 cm. Stipes about 5 - 30 cm long, sparsely covered with ovate-acuminate scales when young, otherwise glabrous, flaccid; lamina 15 - 30 x 9 - 20 cm or more, flaccid, triquadripinnate or supra-decompound, deltoid-lanceolate,

membranous; basal pinnae up to 18 x 6 cm, pinnate, ovate-lanceolate, acuminate; pinnae numerous, usually alternate, rarely opposite, narrowly deltoid, petiolate, narrowly cut down to winged rachis; pinnules ovate, deeply pinnatifid; segments about 1 cm long, ovate-acute, subfalcate, entire with 4 - 5 pairs of lobes; the lowest lobe again pinnate, the upper ones forked or simple; veins slender, blackish, simple, forked. Sori copious, placed near the centre of segments just below the sinus; indusia wider than long, attached by the base only, opens outwards, margin undulating; spores reniform, brown; exine smooth.

Abundant on moss-covered, moist tree trunks in forests; sometimes grows on mossy rocks.

Fertile: July - October.

Distribution: JAVA, POLYNESIA, SRI LANKA, MALAYA, PHILIPPINES, INDIA - South India , Travancore mountains, Meghalaya.

Specimens examined: Jamir 6386 Mezenkong (Mokokchung Dist., 326 m); 6114 Kohima (Kohima dist., 1445 m).

Araiostegia multidentata (Wall. ex Hook.) Copel. in Philip. J. Sci. 34: 241. 1927; Holtumm et al. in Kew Bull. 27(2): 232. 1972.

Davallia multidentata Wall. ex Hook., Syn. Fil. 91.1867.

Leucostegia multidentata (Wall. ex Hook.) Bedd., Ferns Brit. India Suppl. 4. 1876; et Handb. Ferns Brit. India 50. 1883.

Paradavallodes multidentatum (Wall. ex Hook.) Ching in Acta Phytotax. Sinica 11: 20. 1966.

Rhizome up to 1 cm thick, wide-creeping, soft; fleshy, dorsiventrally compressed, densely clothed with basally attached, ovate-lanceolate, golden, pale-brown scales; scales about 1.5 x 1 cm, tip unicerate, terminated by a glandular cell; vascular strand solenostelic with alternating leaf gaps. Stipes 15 - 30 x 0.3 - 0.6 cm, glabrous except at base, pale to dark-brown, shining. Lamina 30 - 50 x 20 - 30 cm, bipinnate, ovate-deltoid, anadromous, membranous; pinnae numerous, subopposite or alternate, petiolate, narrowly deltoid, deeply pinnatifid, winged to the rachis; basal pinnae 30 x 15 cm, pinnate, ovate-lanceolate, acuminate; pinnule up to 12 x 15 cm, deeply cut down into lobes; the basal one largest, oblong, margin crenate, the upper ones crenate or entire; rachis and costae dark-brown with short hairs; texture thin, herbaceous; veins simple, forked. Sori copious small, about 1 -12 in each

segment, attached on a veinlet; indusia thin, circular to oval, attached by base only, opens outwards; sporangia short stalked, 3 - 4 cells long, 2 - 3 cells in thickness; annulus of 10 - 15 thickened cells, vertical; paraphyses short, spores bilateral, flat, tuberculated.

Frequent on moist tree trunks in dense, evergeeen forests; sometimes also noted on moss-covered rocks.

Fertile: October - December.

Distribution: NEPAL, BHUTAN, INDIA -Eastern Himalayas, Assam, Darjeeling, Meghalaya up to 1220 - 1525 m.

Specimens examined: Jamir 6331, 6364 Shamator (Tuensang dist., 1692 m); 7954 Kohima (Kohima dist., 1445 m).

Araiostegia membranulosa (Wall. ex Hook.) Holttum et al. in Kew Bull. 27(2). 230. 1972.

Davallia membranulosa Wall. ex Hook., Sp. Fil. 1: 159. t. 53 A. 1846.

Leucostegia membranulosa (Wall. ex Hook.) J. Smith, Hist. Fil. 84. 1875; Bedd., Handb. Ferns Brit. India 50. 1883.

Davallia membranulosum (Wall. ex Hook.) Copel. in Philip. Sci. 34: 245. 1927.

Paradavallodes membranulosum (Wall. ex Hook.) Ching in Acta Phytotax. Sinica 11: 20. 1966.

(Plate 133)

Rhizome up to 0.8 cm thick, slender, long-creeping, densely clothed with peltate, lanceolate, golden-yellow to whitish, membranous scales; scales about 1 x 0.2 cm, with numerous marginal and superficial hairs, either unicellular or multicellular, vascular strands dorsiventral, solenostelic, dissected by laterally placed leaf gaps and many non-foliar lacunae; roots small, dark-brown, borne in clusters on the ventral surface of the rhizome. Stipes 3 - 7 cm long, articulate to rhizome, dark-brown, glabrous; lamina about 10 - 25 x 4 - 7 cm, bipinnatifid, lanceolate, thinly herbaceous; pinnae numerous, alternate or subopposite, sessile or subsessile, the basal pinnae somewhat reduced to the next above, basal acroscopic pinnule attached to the main rachis than basiscopic one; largest pinnae up to 4 x 1.5 cm, narrowly lanceolate to wing-like; largest pinnule 1 x 0.5 cm, pinnatifid, lanceolate, profusely hairy all over the fronds, hairs mostly persistent at maturity either unicellular or multicellular; rachis and costae greenish with very short hairs; veins free, forked. Sori dorsal, 1 - 8 on each segment of the pinnule, terminal on veinlets, obliquely placed between the costa and the margin; indusia thin, small, pale-brown, semicircular to ovate, attached at broad base, margin entire; spores oblong, hyaline; flat, tuberculate.

Frequent in moist dense, evergreen forests.

Fertile: July - December.

Distribution: YUNAN, NEPAL, INDIA - Kumaon, Moharguri pass up to 1980 m elevation.

Specimens examined: Jamir 6143 Phek (Phek dist.,1200 m); 7917 Kohima (Kohima dist., 1445 m).

✓Araiostegia pulchra (D. Don) Copel. in Philip.. J. Sci. 37: 241. 1929; Iwatsuki in Hara, Fl. East. Himal. (3 Rep.) 179. 1975; Dhir, Ferns N. W. Himalayas 57. 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 100. 1982.
Davallia pulchra D. Don, Prodr. Fl. Nepal 11. 1825; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 444. 1880.
Leucostegia pulchra (D.Don) Bedd., Handb. Ferns Brit. India 52, t. 25. 1883.

Rhizome wide-creeping, thick, clothed with broad, obtuse, pale-brown scales; scales about 0.5 x 0.2 cm. Stipes 8 - 15 cm, long, glabrous except at base; lamina up to 35 x 20 cm, deltoid-lanceolate, triquadripinnatifid, membranous; basal primary pinnae up to 15 x 5 cm, pinnate, ovate-lanceolate; pinnae numerous, opposite or alternate, sessile or petiolate; the lowest pinnule up to 5 x 3 cm, cut down to a narrowly winged rachis, pinnatifid with 2 - 5 pairs of lobes; the lobes about 1.5 x 1 cm; the upper lobes of pinnae forked or simple; texture thin, rather flaccid; veins prominent,

not reaching the tip of the lobes. Sori copious on veins; indusia reniform, attached from the broad base, acute at apex, opens outwards; spores oval or reniform, brownish; exine finely tuberculate.

Abundant and infact one of the extremely common epiphytes of the state; grows on moist tree trunks or sometimes on moss-covered rocks in dense forests.

Fertile: October.

Distribution: NEPAL, BHUTAN, SRI LANKA, INDIA: Deccan Peninsula up to 1550 m; Himalayas, Meghalaya.

Specimens examined: Jamir 6505, Changki (Mokokchung dist., 1000 m).

3. Humata

Cavanilles, Descr. Plant. 272. 1802; Copel., Gen. Fil. 88. 1947.

Mostly epiphytes, sometimes on rocks. Rhizome slender, long-creeping, covered throughout with narrow, brown scales, peltate at base, attenuate at apex, Stipes articulate to rhizome, grooved, sparsely covered with brown scales; lamina usually deltoid, tripinnatifid, rarely simple, fleshy, coriaceous; fertile lamina usually more dissected than those

of sterile ones; venation free, forked. Sori globose, marginal or submarginal, terminal on veins; indusia coriaceous, scale-like, attached by a lateral base, free at apex and side; sporangia long stalked; spores hyaline.

A genus of about 50 species; 1 in Nagaland.

✓Humata repens (Linn.f.) Diels, in Nat. Pflanzenfam. 209. 1889; Holttum, Fl. Malaya 2: 371. 1954; Baishya & Rao, Ferns & Fern-allies Meghalaya 102. 1982.

Adiantum repens Linn. f., Suppl. 446. 1781.

Humata pedata (Smith) J. Smith in J. Bot. 3: 416. 1841; Bedd., Handb. Ferns Brit. India 48. t. 23, 1883.

Humata pinnatifida (Baker) Bedd., Handb. Ferns Brit. India Suppl. 12. 1892.

(Plate 134)

Rhizome 0.2 - 0.3 cm thick, slender, long-creeping, densely clothed with peltate-lanceolate, acuminate, brown scales; scales about 0.6 x 0.1 cm. Stipes 2 - 10 cm long, slender, grooved, sparsely hairy. Stipe scales similar to rhizome scales; lamina 4 - 8 x 3 - 6 cm, deltoid in outline, usually cut down quite to the rachis; the lowest basal pinnae up to 3.5 x 2 cm, deltoid, deeply pinnatifid, cut down nearly to the costae (or basal lobes rarely free as separate pinnae); the lower pair of segments or pinnules larger than the others, nearly falcate, slightly tapering

from the base towards rounded apex, the upper ones entire; the lower one lobed on the basiscopic edge, the lowest one broader than the rest, enlarged at the base on the basiscopic side, deeply lobed on the basiscopic edge and slightly lobed on the acroscopic edge; secondary lobes or segments up to 1 x 0.5 cm, entire, rounded in sterile lamina; fertile ones with the segments crenated or a tooth flanking each sorus; texture coriaceous, undersurface with small sparse scales. Veins forked, free at the margins. Sori small, elongate, in rows on the teeth on both sides of the lobes; indusia semi-circular or slightly widened above the base, margin entire, pale-brown, glabrous; spores reniform, greenish-yellow; exine smooth.

Common; grows on rocks and tree trunks along the roadsides.

Fertile: October - February.

Distribution: MALAYA, S. CHINA, JAPAN, TAIWAN, N. AUSTRALIA, BHUTAN, SRI LANKA, INDIA - South India, Northern India - Sikkim, Meghalaya up to 1220 m elevation.

Specimens examined: Jamir 6191, 7067 Changki (Mokokchung dist., 1000 m).

4. Davallia

Smith, Mem. Acad. Turin. 5: 414. 1743; C.Chr., Ind. Fil. 207. 1906; Copel., Gen. Fil. 87. 1947.

Epiphytes, rarely terrestrials. Rhizome long-creeping, rounded, densely covered with peltate, whitish-yellow scales. Stipes glabrous, articulate to rhizome; lamina deltoid or pentagonal, decompound, usually finely dissected, texture firm, coriaceous; veins free. Sori terminal on veinlets; indusia elongate, tubular, attached by base as well as sides; sporangia slender-stalked; annulus incomplete, vertical; spores oblong to reniform, hyaline.

A genus of 30 species; 3 in Nagaland.

K E Y T O S P E C I E S

1a. Rhizome scales white . . . . . griffithiana

1b. Rhizome scales brown to chest-nut brown.

2a. Rhizome 1 - 2 cm wide; indusium as long as broad . . . . . divaricata

2b. Rhizome 1 cm or less wide; indusium longer than broad, funnel-shaped . . . . . trichomanoides

Davallia divaricata Blume, Enum. Pl. Jav. 237. 1828; Bedd., Handb. Ferns Brit. India 60. 1883; Holttum, Fl. Malaya 2: 362. 1968; DeVol & T. Yang in Fl. Taiwan 1: 272. (ed.2). 1980.

Rhizome about 1 cm thick, stout, densely clothed with thin, rather transparent, chest-nut brown, deltoid to ovate-lanceolate scales; scales about 1 x 0,4 cm. Stipes 20 - 30 cm long, erect, firm, glabrous except at base; lamina 30 - 60 x 15 - 25 cm, deltoid-lanceolate in outline, tripinnate; basal pinnae 16 x 10 cm, deltoid-acuminate, deeply tripinnatifid; pinnae subopposite or alternate, upper pinnae sessile, lower stalked, glabrous, larger pinnules 6 x 3 cm, deltoid, cut down to lobes; sterile lobes 1.5 x 0.6 cm, entire, sharply toothed or crenate; texture subcoriaceous, dark, reddish-brown when dry; lobes of fertile ones elliptic-oblong, veins uniformly forking, not conspicuous. Sori brownish, submarginal, facing obliquely outwards; indusia tubular or half cup-shaped, attached at base, opening towards apex of the lobes, usually wider than long or more or less equal.

Rare; on moist tree trunks in natural forests.

Fertile: December.

Distribution: S. CHINA, BURMA, MALAYA, TAIWAN, PHILIPPINES, INDIA - Sikkim, Meghalaya.

Specimrns examined: Jamir 7246 Kikewma (Kohima dist., 1600 m).

Davallia griffithiana Hook., Sp. Fil. 1: 168. t. 48 B, 1846; et Syn. Fil. 96. 1867; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 445. 1880; Bedd., Handb. Ferns Brit. India 60. 1883; DeVol & T.Yang in Fl. Taiwan 1: 273. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 100. 1982.

Humata griffithiana (Hook.) C. Chr. in Contr. U.S. Nat. Herb. 26: 293. 1931.

(Plate 135)

Rhizome 0.8 - 1 cm thick, fleshy, long-creeping, densely clothed with long, linear-lanceolate, caudate, white or yellowish, hair-tipped scales; scales about 1 x 0.2 cm, scabrous, margin with long hairs. Stipes 7 - 20 x 0.2 - 0.4 cm, erect, wiry; lamina 15 - 45 x 8 - 30 cm, tri-quadripinnatifid, deltoid-acuminate, flaccid; the lowest basal primary pinnae up to 25 x 12 cm, bipinnatifid, ovate-lanceolate; pinnae numerous, opposite or alternate, sessile, or stalked; stalk up to 0.6 cm long; the lowest pinnules of pinnae up to 8 x 3.5 cm, deltoid-lanceolate, deeply segmented; lower segments toothed on the sterile lamina,

cut down nearly to the rachis in the fertile ones, texture coriaceous. Sori large, globose, submarginal or marginal, developing in basipetal succession; indusium white, glabrous, cup-shaped, shortly attached at base and sides, half opening towards the apex.

Very common throughout the state; on moist tree trunks both in open and shady places, sometimes grows on moss-covered rocks.

Fertile: June - October.

Distribution: CHINA, TAIWAN, BHUTAN, MISHMEE, INDIA-Nothern India; Himalayas and Meghalaya.

Specimens examined: Jamir 6183, 7071, 7020 Changki (Mokokchung dist., 1000 m); 7163 Mokokchung dist., 1325 m); 7127 Kohima (Kohima dist., 1445 m).

✓ Davallia trichomanoides Blume, Enum. Pl. Jav. 238. 1828; Holttum Fl. Malaya 2: 361. 1968; Baishya & Rao, Ferns & Fern-allies Meghalaya 101. 1982.

Davallia bullata Wall. ex Hook., Sp. Fil. 1: 169, t. 50 B, 1846; Clarke in Trans. Linn. Soc. Ser. 2, (Bot.) 1: 445. 1880; Bedd., Handb. Ferns Brit. India 61. 1883.

Rhizome about 0.5 cm thick, wide-creeping, fleshy, densely clothed with lanceolate, dark-brown scales; scales about 0.2 - 0.7 cm long, base peltate, rounded, apex hair-tipped, much narrower, margin finely ciliate. Stipes 5 - 10 cm long, erect, glabrous, dark-purplish to pale; lamina 10 - 25 x 8 - 18 cm, tri-quadripinnatifid, deltoid-acuminate, flaccid; the lowest basal pinnae 10 x 5 cm, ovate-lanceolate, pinnae numerous, usually alternate or subopposite, petiolate or sessile; the lowest pinnule up to 4 x 2 cm, deeply pinnatifid, giving rise to oblong-rhomboid segments texture thin but firm. Sori elongate, marginal, terminal on the veins occupying larger part of the tooth of the segments; indusium longer than broad, funnel-shaped, attached at base and sides; open towards apex.

Exceedingly common; on moss-covered tree trunks associated with other ferns.

Fertile: July - October.

Distribution: JAPAN, SRI LANKA, MALAYA, BURMA, NEPAL, BHUTAN, CHINA, INDIA - Deccan peninsula, Meghalaya.

Specimens examined: Jamir 6517 Wokha (Wokha dist., 6575 Changki (Mokokchung dist., 1000 m).

5. Gymnogrammitis

Griff., Icon. Pl. As. 2: t. 129. 1849; Notul. Pl. As. 2: 608. 1849.

Epiphytes. Rhizome creeping, densely clothed with clathrate, brown, lanceolate scales; scales terminating into long hair-tipped, margin with sharp tubercle -like projections. lamina pinnate, placed on swollen disc-like phyllopodia on rhizome, remote; pinnae variously pinnatifid. Veins forked, simple, free. Sori globose, superficial on veins; indusia absent; sporangia sessile; annulus interrupted; spores bilateral, yellowish-brown; exine irregularly winged.

A genus of species; 1 in Nagaland.

Gymnogrammitis dareaeformis (Hook.) Ching ex Tirdia et C.Chr., Notol. Syst. Paris 6: 2. 1937; Baishya & Rao, Ferns & Fern-allies Meghalaya 102. 1982.

Polypodium dareaeforme Hook., Ind. Gent. Ferns t. 24, 1860; Bedd., Handb. Ferns Brit. India 316. 1883.

Davallia dareaeformis sensu Clarke in Trans. Linn. Soc. Ser. 2,(Bot.) 1: 443. 1880.

Rhizome about 1 cm thick, long-creeping, densely clothed with golden-brown, lanceolate, hair-tipped scales; scales 0.7 x 0.1 cm, cordate at base, cells clathrate, margin

sparsely dentate. Stipes 6 - 12 x 0.2 - 0.3 cm, glabrous, glossy, shining, articulate to rhizome; lamina 20 - 40 x 15 - 25 cm, sub-deltoid to ovate, tri-quadripinnate; glabrous; largest basal pinnae 15 x 6 cm, deltoid-lanceolate in outline; secondary pinnae or pinnules about 3 x 1.5 cm, deeply segmented; tertiary pinnae small, forked (or pinnate); the ultimate segments narrow, spathulate, acute to round, entire, caducous; texture herbaceous; primary and secondary rachis dark-purplish, shining, glabrous; veins single to each ultimate segment, not reaching the margin. Sori dorsal, superficial on veins, extending beyond the segments; indusia absent; sporangia globose, pale-brown; spores round, yellowish-brown.

Not common, on moist tree trunks in dense, natural forests.

Fertile: May - July.

Distribution: INDIA - Himalayas and sub-Himalayas up to 1525 m elevation.

Specimens examined: Jamir 7212 Changki (Mokokchung dist., 1000 m); 7160 Kohima peak (Kohima dist., 1445 m).

38. BLECHNACEAE

Presl., Tent. 97. 1836 (as a section of Aspleniaceae); Epim. Bot. 103. 1849 (as Tribe); Copel., Gen. Fil. 155. 1947 (as family); Holttum in Biol. Review 24: 289. 1949 (as sub-family).

Terrestrials. Rhizome dictyostelic, erect or ascending, branched, trunk-like or sometimes slender, climbing, and profusely branched; covered by non-clavate, basally attached gland-tipped palea. Stipes scaly at base, not articulate to rhizome, vascular strands several, often with ribbon-like meristeles with spirally arranged leaf gaps. Fronds spirally arranged on rhizome, tufted or scattered, monomorphic or dimorphic; lamina large, coarse, pinnatifid or pinnate, rarely bipinnate; veins free, forked or sometimes anastomosing. Sori elongated, close to midrib, discrete or fused to form coenosori, parallel to costae; indusium superficial or marginal; sporangia large, long-stalked, crowded; annulus interrupted, vertical, consisting of 15 - 30 thickened cells; spores monolete, bilateral; exine smooth or granular.

A family of 12 genera; 2 in Nagaland.

K E Y T O G E N E R A

Rhizome erect, stout forming caudex;
fronds monomorphic; sori fused forming
coenosori . . . . . 1. Blechnum
Rhizome climbing, herbaceous; fronds
dimorphic; sori free . . . . . 2. Stenochlaena

Blechnum

Linn., Sp. Pl. 2: 1077. 1753; C. Chr., Ind. Fil. 150. 1906; Copel., Gen. Fil. 155. 1947.

Rhizome creeping or erect, stout, sometimes forming a distinct caudex, dictyostelic, paleate; scales crowded, small, linear, dark-brown, shining; fronds monomorphic or rarely dimorphic, spreading, coriaceous, pinnate; pinnae sometimes decurrent on the stipe; venation parallel, free. Sori linear forming coenosori, along the costa; sporangia crowded, borne on a vein parallel to costa; indusium linear, firm, opening along the costa, spores monolete, bilateral; exine smooth or granular.

A large genus of about 200 species; only 1 in Nagaland.

Blechnum orientale Linn., Sp. Pl. 1077. 1753; Bedd., Handb. Ferns Brit. India 132, t. 66. 1853; et Ferns South India Pl. 29. 1869; Holttum, Fl. Malaya 2: 446. 1968; DeVol, Fl. Taiwan 1: 151. (ed. 2). 1980; Baishya & Rao, Ferns & Fern-allies Meghalaya 118. 1982.

(Plate 136)

Caudex short, erect, massive, densely covered by linear-lanceolate, shining, dark-brown scales at the apex; scales up to 2 x 0.3 cm. Stipes 15 - 65 x 0.2 - 0.7 cm, tufted erect, scaly at base. Fronds up to 180 x 75 cm, pinnate; pinnae linear-lanceolate, 8 - 35 x 1 - 2 cm, spreading, coriaceous, glabrous, base of pinnae adnate on the lower side, free above, narrowed at apex; veins simple or forked parallel, free. Sori linear, costal, continuous nearly to apex; indusium narrow, firm, near costae, opening inwardly, margin entire; annulus oblique, 17-celled; spores round or oval, translucent, pale with narrow median wing.

Very common along road cuttings and in open places on hills.

Fertile: July - November.

Distribution: ASIA, AUSTRALIA, PACIFIC ISLANDS, INDIA-Meghalaya .

Specimens examined: Jamir 6169 Changki (Mokokchung dist., 1000 m).

Stenochlaena

J. Smith, J. Bot. 3: 402. 1841; C. Chr., Ind. Fil. 624. 1906; Copel., Gen. Fil. 161. 1947.

Rhizome creeping or climbing, herbaceous, scaleless when mature, peltate brown scaly at growing end; vascular system complex, much dissected. Stipes glabrous at maturiy, well-spaced on the rhizome. Fronds simple pinnate, dimorphous, lateral pinnae usually articulate; sterile fronds with elliptical pinnae, margin sharply toothed; veins forming a single areole close to the costae, otherwise free, oblique, simple or forked, no main veins; fertile fronds much different; pinnae narrowly linear. Sori densely covering the lower surface, brown; each sorus on a branched vascular commissure in addition to the normal veins, and anastomosing with them; spores bilateral, hyaline, translucent; papillose, perispore absent.

A genus of 3 - 4 species; 1 in Nagaland.

✓ Stenochlaena palustris (Burm.) Bedd., Ferns Brit. India Suppl. 26. 1876; et Handb. Ferns Brit. India 421, t. 253. 1883.

Polypodium palustre Burm., Fl. Zel. 234. 1768; Holttum, Fl. Malaya 2: 412. 1968.

(Plate 137)

Rhizome scandent, often climbing on trees. Scales absent. Stipes 10 - 25 x 0.4 - 0.8 cm, glabrous. Fronds 30 -90 cm long, glabrous, shining; pinnae 8 - 15 pairs, articulate, alternate or opposite, lanceolate-acuminate, serrate, acute at apex, oblique at base, 10 - 25 x 2 - 3.5 cm; fertile fronds much contracted, pinnae up to 25 x 4 cm. Sori densely covering the lower surface except midrib and extreme apex; sporangia large, stalked, crowded; annulus interrupted, consisting of 10 - 25 celles; spores bilateral, hyaline, translucent; papillose, perispore absent.

Rare; in low lands, usually climbing on other trees in forests.

Fertile: October - December.

Distribution: MALAYA, QUEENSLAND, FIJI AND AUSTRALIA, INDIA - South and North India, Meghalaya.

Specimens examined: Jamir 7940 Chemuketema (Kohima dist., 250 m).

39. AZOLLACEAE

Small, free-floating, aquatic ferns. Stems short, slender, alternately branched to left and right. Leaves in two alternate rows. Roots either singly or in groups, hanging, immersed in water, bearing numerous fine rootlets. Leaves bilobed, with one floating and another submerged lobe, small, imbricating; upper aerial lobe covered with papillae and overlapping the rhizome; lower submerged lobe only one cell in thickness. Sori in sporocarps; sporocarps usually borne in pairs, microsporocarps globose, containing stalked microsporangia, attached or imbedded to massulae; megasporocarps ovoid, containing a basal megasporangium with a collar and 1 or 2 tiers of floats with an apical flagellate, funnel-like zone; spores small, round, translucent.

Only genus of the family, Azolla Lamk.

Azolla

Lamk., Encycl. Meth. 1: 343. 1783; C. Chr., Ind. Fil. 147. 1906; Copel., Gen. Fil. 232. 1947.

Characters of the family.

About 7 species; 1 in Nagaland.

Azolla pinnata R. Br., Prodr. Fl. Nov. Holl. 167. 1810; Holttum, Fl. Malaya 2: 621. 1968; DeVol, Fl. Taiwan 1: 60 (ed. 2). 1980.

Azolla imbricata (Roxb.) Nakai in Bot. Mag. Tolyo 39: 183. 1925.

(Plate 138)

Plants about 2 x 1 cm, triangular. Roots up to 4.5 cm long, unbranched, with numerous root-hairs. Leaves less than 0.5 cm long; massulae bearing a few trichomes on ventral side; microsporocarps globose, containing stalked, microsporangia; megasporocarps ovoid, smaller than microsporocarps with a basal megasporangium with 2 tiers of floats and a terminal flagellated crown. Spores small, round, translucent.

Common in paddy fields when the fields are inundated; also found in stagnant waters or in ponds near villages in plains. This species has tremendous capacity for vegetative multiplication.

Fertile: May - August.

Distribution: AFRICA, AUSTRALIA, ASIA, TAIWAN, MALAYA, INDIA - throughout in low lands.

Specimens examined: Jamir 7075 Dimapur (Kohima dist., 200 m); 7943 Changki (Mokokchung dist., 1000 m).

40. SALVINIACEAE

Small aquatic, free-floating, annual, herbaceous ferns. Rhizome horizontal (dorsiventral), branching freely, hairy, rootless, stelar organisation siphonostelic; leaves of two types; upper green, floating leaves, exposed to the air in pairs, midrib distinct with anastomosing veins, dorsal surface covered with papillae and ventral surface covered with straight, multicellular hairs; submerged leaves finely divided into numerous, root-like segments. Sori in special seed-like bodies called sporocarps; sporocarps globose, in clusters, borne on the submerged, dissected root-like leaves, covered with multicellular hairs; external appearance quite alike but containing two types; some containing megasporangia, other microsporangia.

Solitary genus of the family Salvinia Adanson.

Salvinia

Adanson, Fam. d. Plant. 2: 15. 1763; C. Chr., Ind. Fil. 615. 1906; Copel., Gen. Fil. 232. 1947.

Characters of the family.

About 10 species of which only 1 in Nagaland.

Salvinia natans. Hoffm., Gernm. 11, Fl. Sch. Crypt. t. 173; Baker in Fern allies 173. 1887; Chowdhury, Pterid. Fl. Upper Gang. Plain 25. 1973; DeVol, Fl. Taiwan 1: 58 (ed. 2). 1980.

(Plate 139)

Small aquatic, free-floating ferns. Rhizome small, clothed with hairs, roots absent, horizontal; floating leaves 0.8 - 1.5 x 0.5 - 1 cm, small, oval-oblong; papillate on upper surface, with 4-free hairs on the tip of each papilla; submerged leaves root-like, up to 5 cm long, 4 - 8 in a cluster, globose or ovoid, brown, with hexagonal wall cells; sporocarps of two types, some containing megasporangia and others microsporangia, covered by minute multicellular hairs.

Common in ponds, paddy fields and stagnant waters in lower elevations. One of the major aquatic weeds in low lands.

Fertile: May - December.

Distribution: EUROPE, AFRICA, NORTH AMERICA, ASIA, INDIA - Indo-Gangetic plains; Meghalaya.

Specimens examined: Jamir 6042 Tejit (Mon dist., 200 m).

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myriocarpa Mull.13
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PLATES

Plate 1: 'A' and 'B' : View of evergreen forest in Nagaland. (Japvo Hill)

A

B

Plate 2 : 'A' and 'B' : view of evergreen forests near Chumuketema and Helipong forest.

A

B

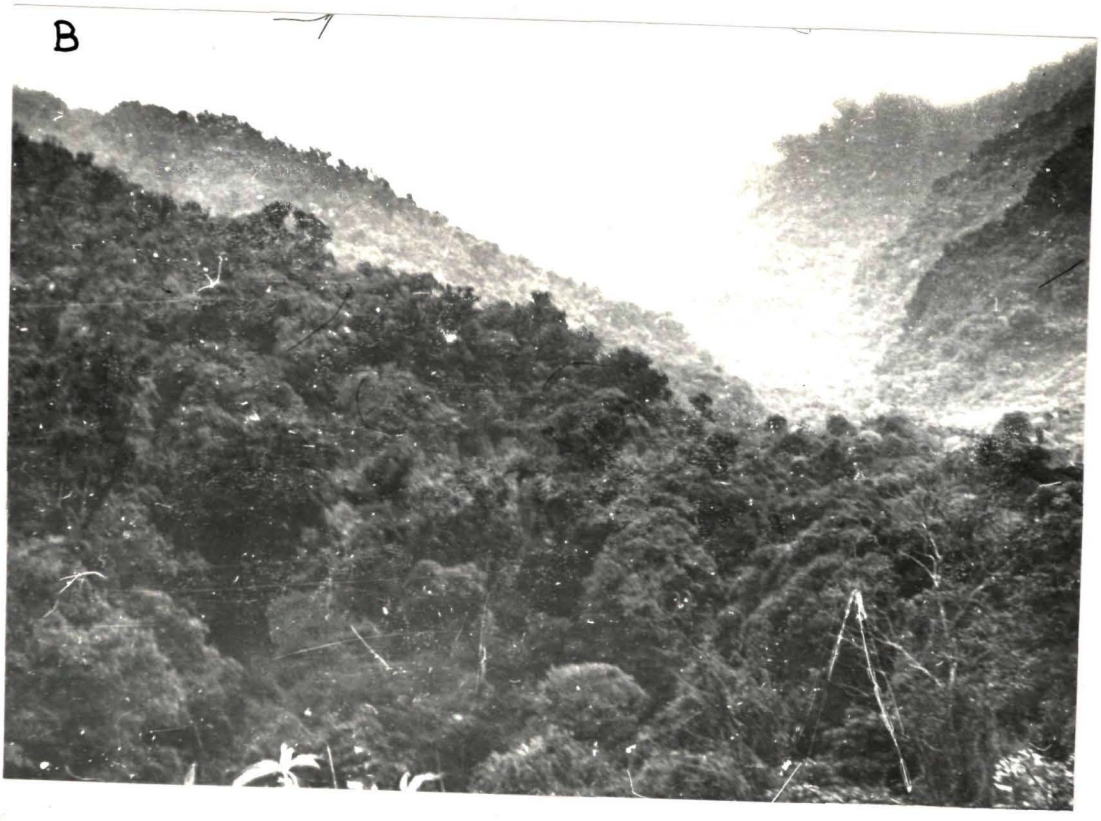


Plate : 3: 'A' - Clearing of forests for shifiting Agriculture.

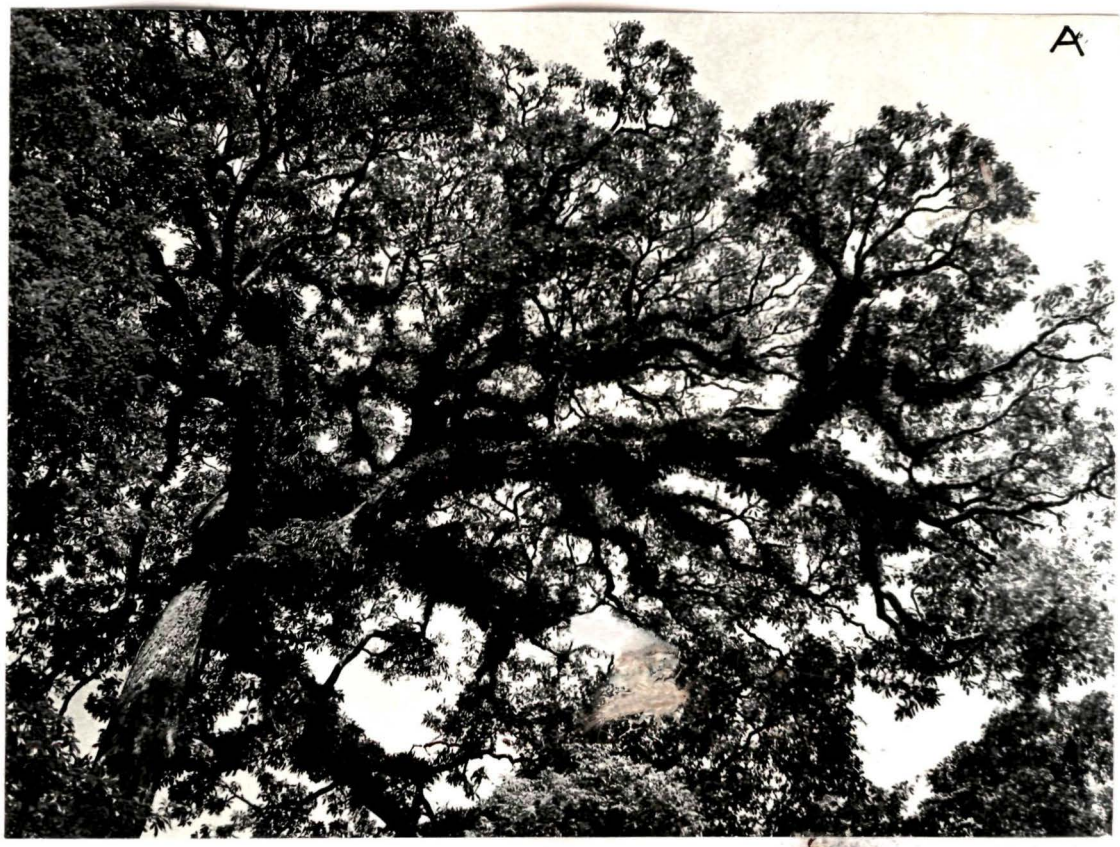
'B' - A view of rocky forest vegetation.

A

B

Plate 4 : 'A' - Luxuriant growth of epiphytic flora in a temperate forest.

'B' - View of mixed evergreen forests.


A

B

Plate 5 : 'A' - View of Pine forests.

'B' - View of a moist deciduous forest .

A

B

Plate : 6'A' and 'B' : View of temperate forests.

A

B

Plate 7 : 'A' - Dense patch of Cyclosorus gongylodes (Schkur) Link. in a swampy area near Dimapur.

'B' - Dense patch of Selaginella near Kohima Science College.

A

B

Plate 8 : 'A' - Dense growth of Neocheiropteris normalis (D.Don) Tagawa

'B' - A population of Dryopteris palacea (Moore) at Formin, Palebadge peak.

A

B

Plate 9 : 'A' and 'B' : Gregarious Cyathea Spp. in a dense moist forest near Changki village.

A

Plate 10 : 'A' - Association of two epiphytic ferns namely *Asplenium phyllitides* D.Don and *Microsorum superficiale* (Blume) Ching.

'B'- A tree trunk showing epiphytic growth of ferns.

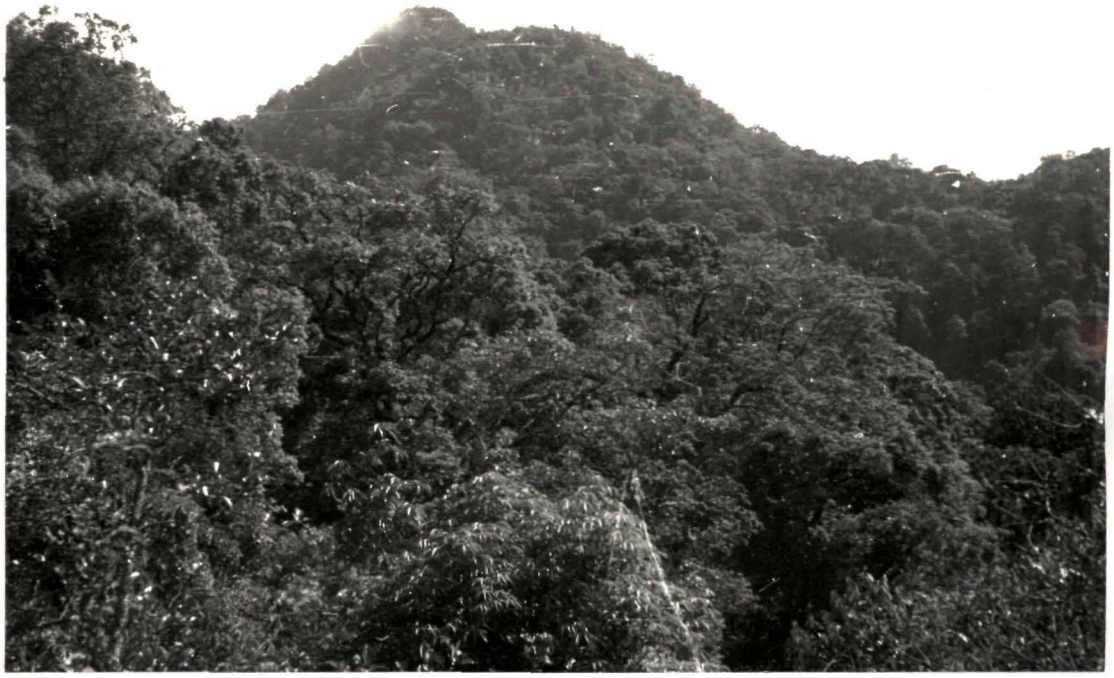
A

B

Plate 11 : 'A' - View of a dense natural forest in Palebadge forests, Kohima.

'B' - A denuded forest showing the growth of wild Banana near Pfutsero town.

A

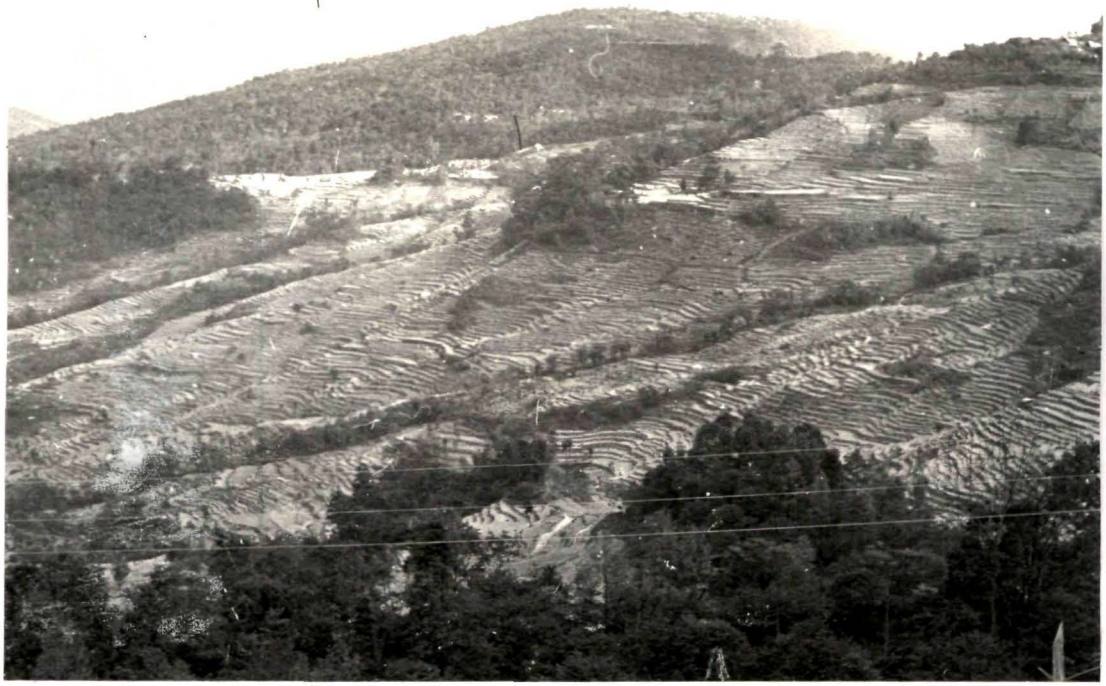


B

Plate 12 : 'A' - A view of Terrace cultivation near Kohima.

'B' - View of a riverine vegetation.

A



B

Plate 13 : 'A' - View of a semievergreen forest near Japvo Hill, Kohima.

'B' - View of a Hill forest.

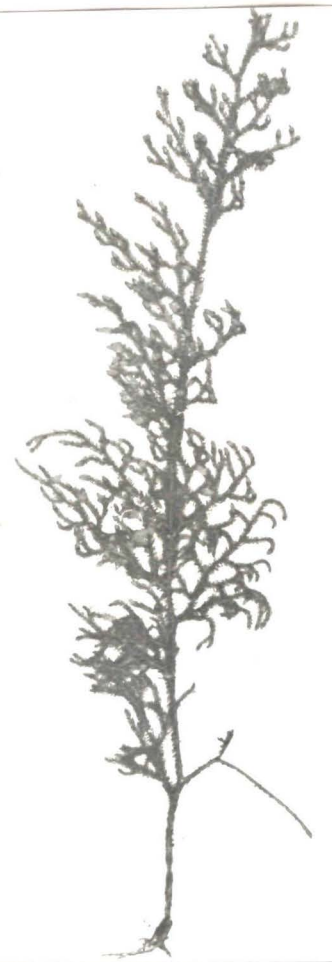
B

Plate 14 : 'A' Lycopodium cernuum Linn.

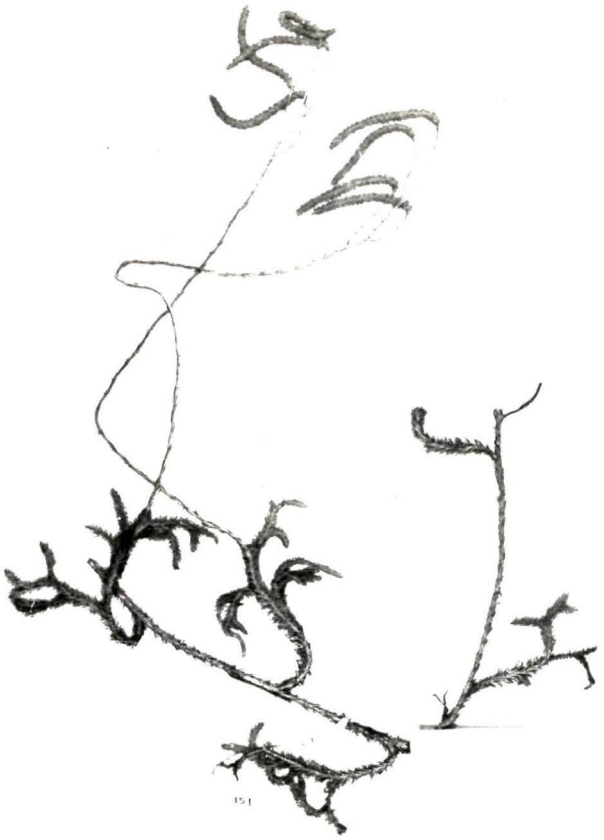
'B' - Lycopodium clavatum Linn.

'C' - Lycopodium setaceum Buch-Ham.

'D' - Lycopodium squarrosum Forst.

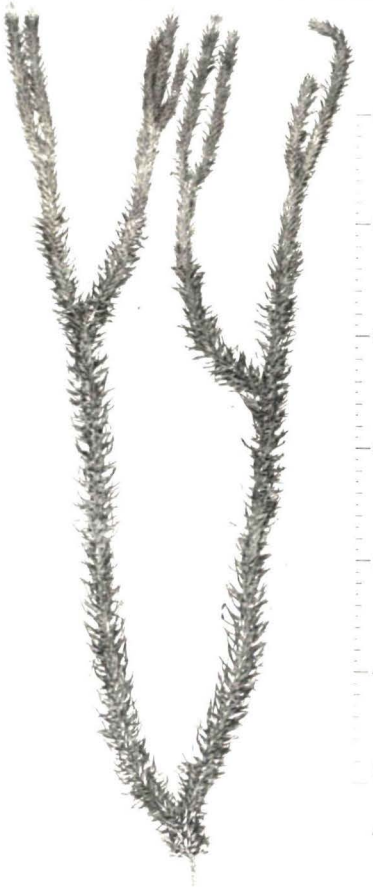


A



B

C



D

Plate 15 : 'A' - Lycopodium serratum Thunb.

'B' - Lycopodium phlegmaria Linn.

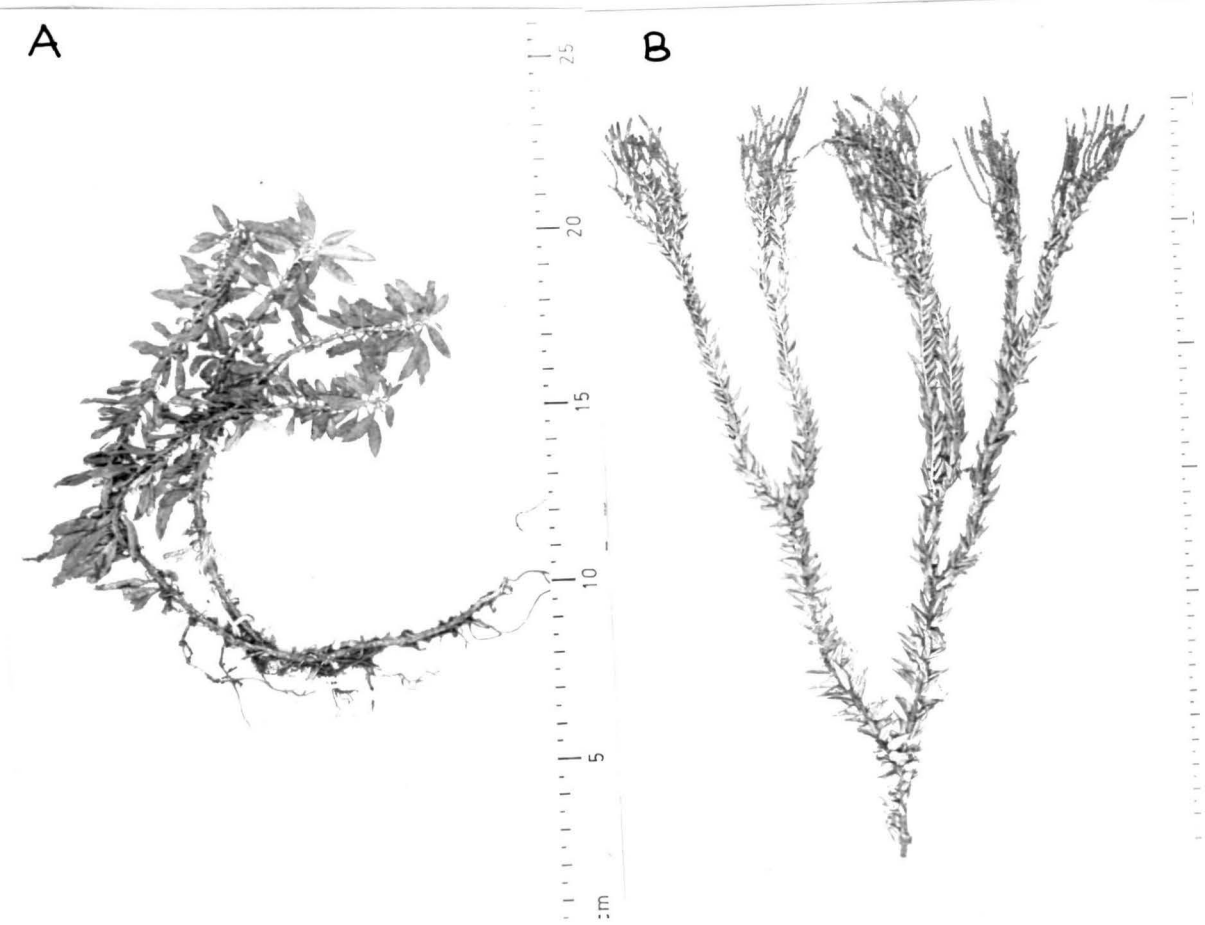

A
B
25
20
15
10
5
cm

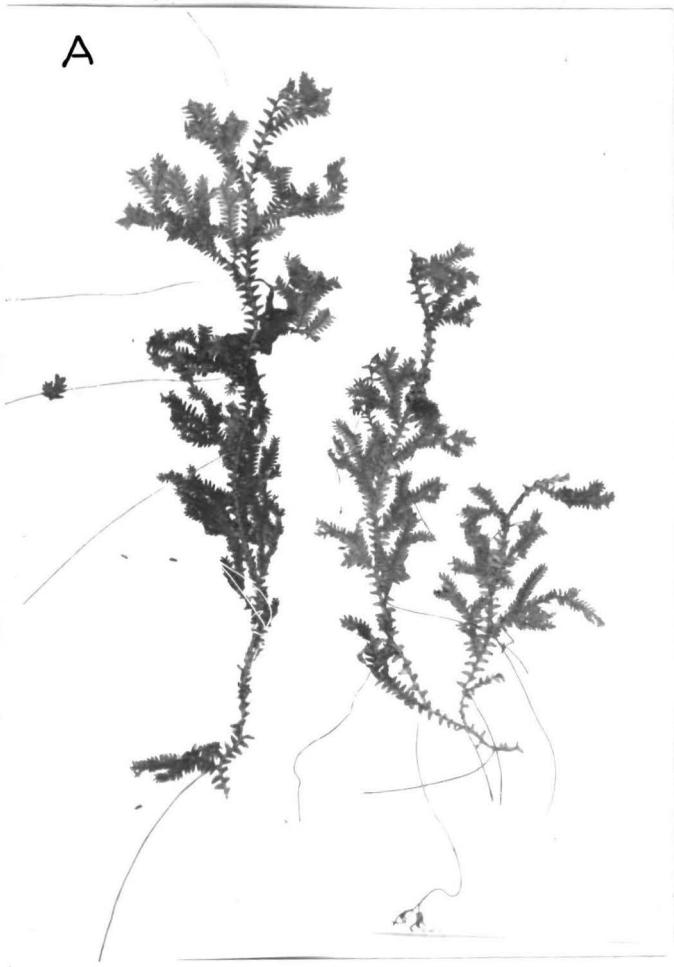
Plate 16 : 'A' - Selaginella semicordata (Wall.) Spring.

'B' - Selaginella decipiens Wart.

'C' - Selaginella hookeri Baker.

'D' - Selaginella chrysocaulos (Hook. et Grev.) Spring.

A



B

C

D

Plate 17 : 'A' - Selaginella ciliaris (Retz.) Spring.

'B' - Selaginella involvens (Sw.) Spring.

A
B

Plate 18 : 'A' - Selaginella wallichii Spring.

'B' - Selaginella willdenovii (Desv.) Baker.

A
B

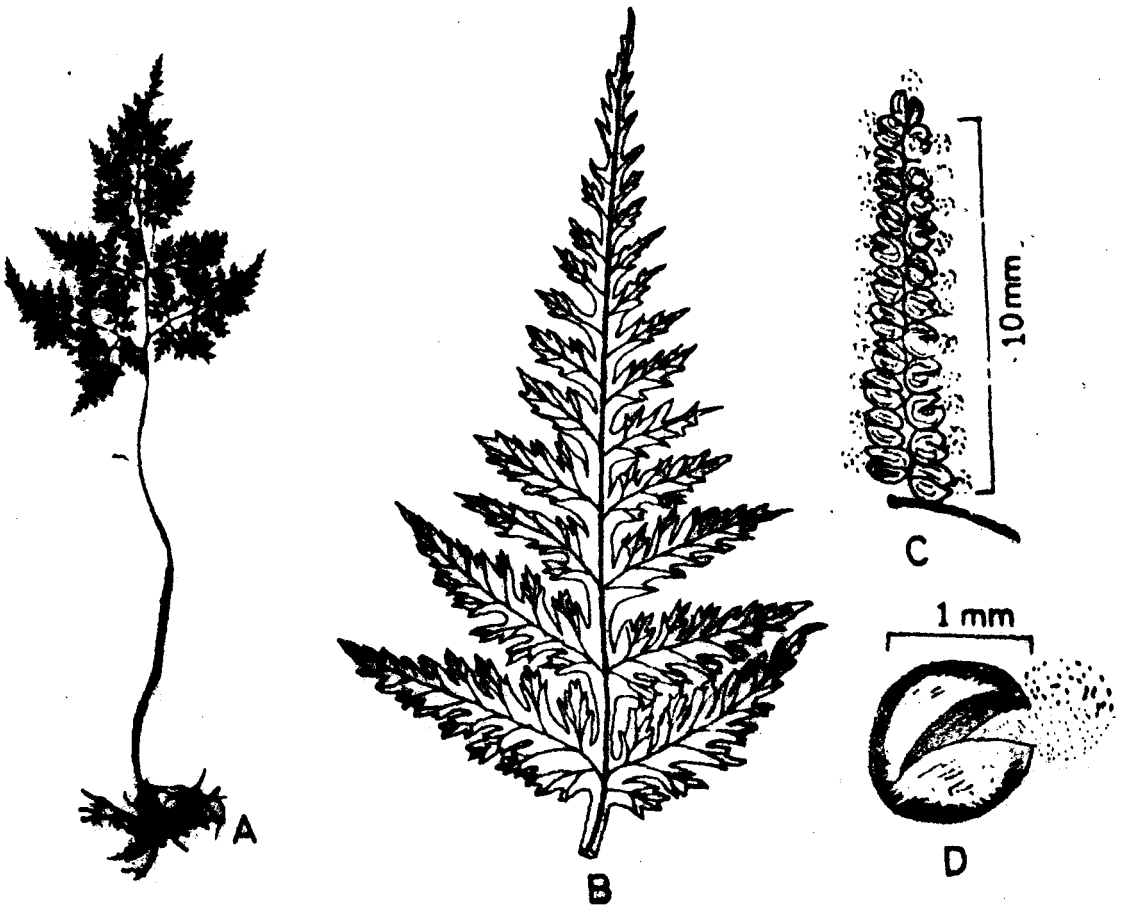


Plate 18: Botrychium lanuginosum Wall. ex Hook. et Grev.
A - Habit; B - sterile pinna enlarged; C - fertile pinnule; D - sporangium.

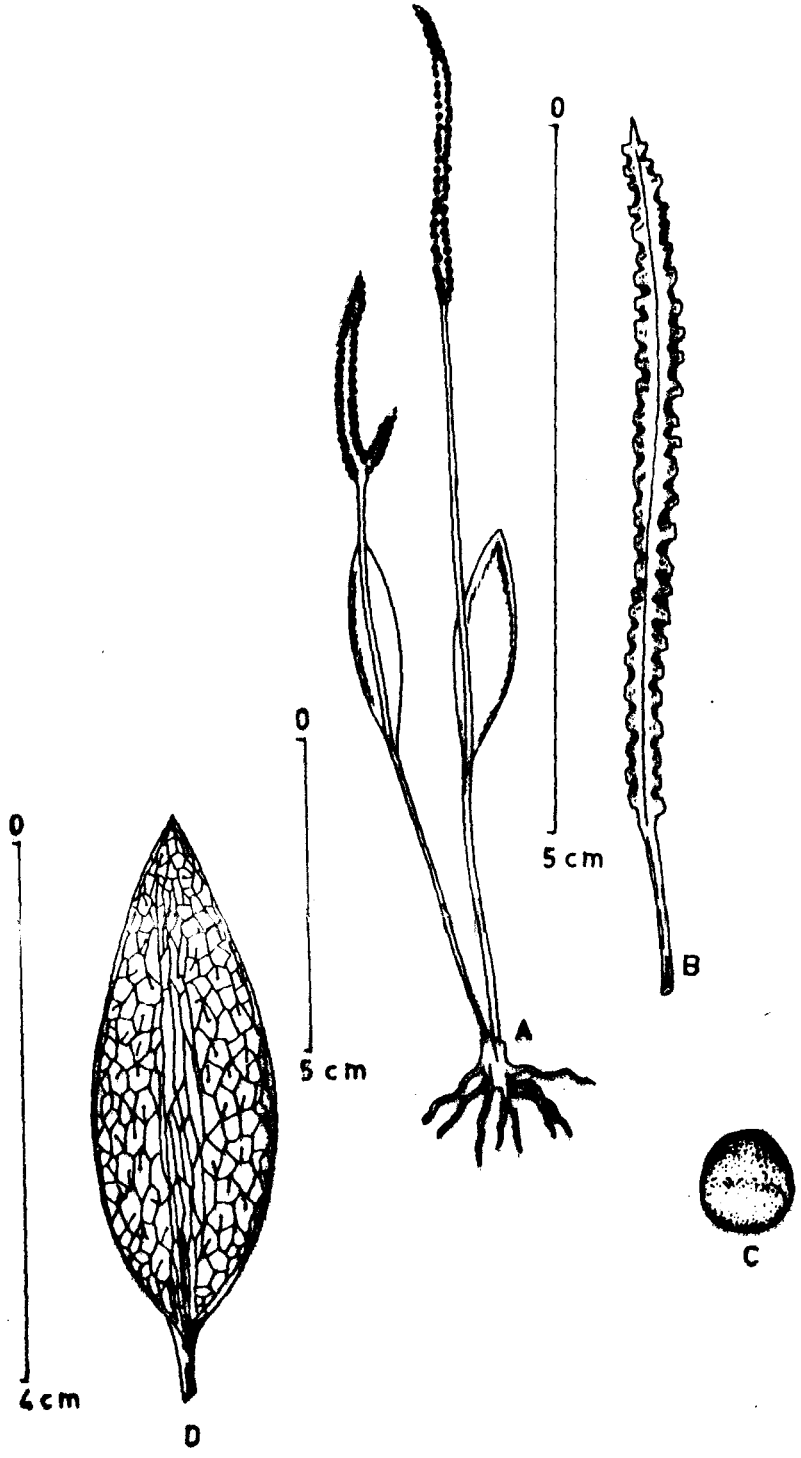
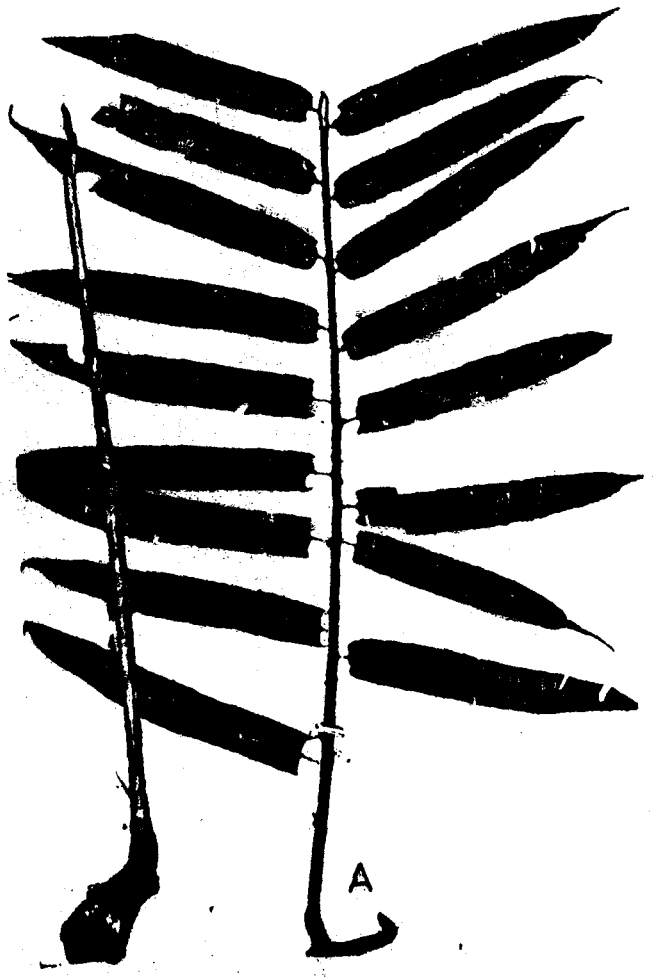
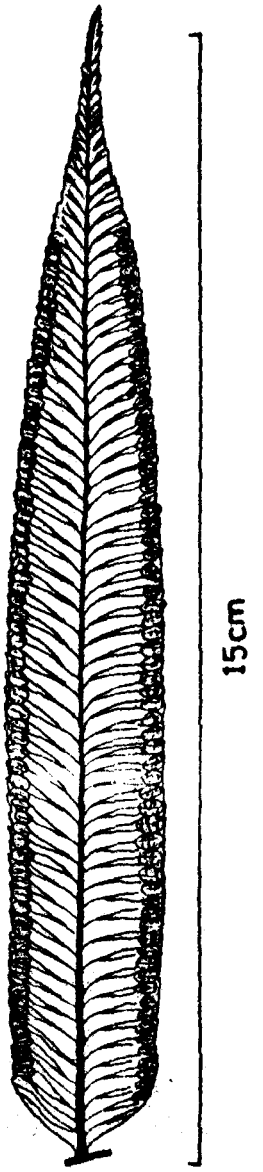


Plate 19: Ophioglossum petiolatum Hook. A - Habit; B - fertile spike; C - spores; D - reticulate venation.





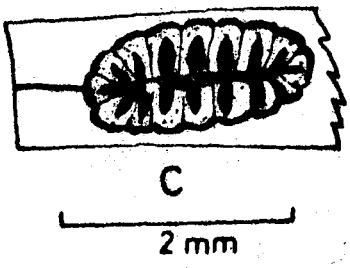


Plate 20: Angiopteris evecta (Forst.) Holfm.
A - Habit; B - fertile pinna;
C - sorus enlarged.

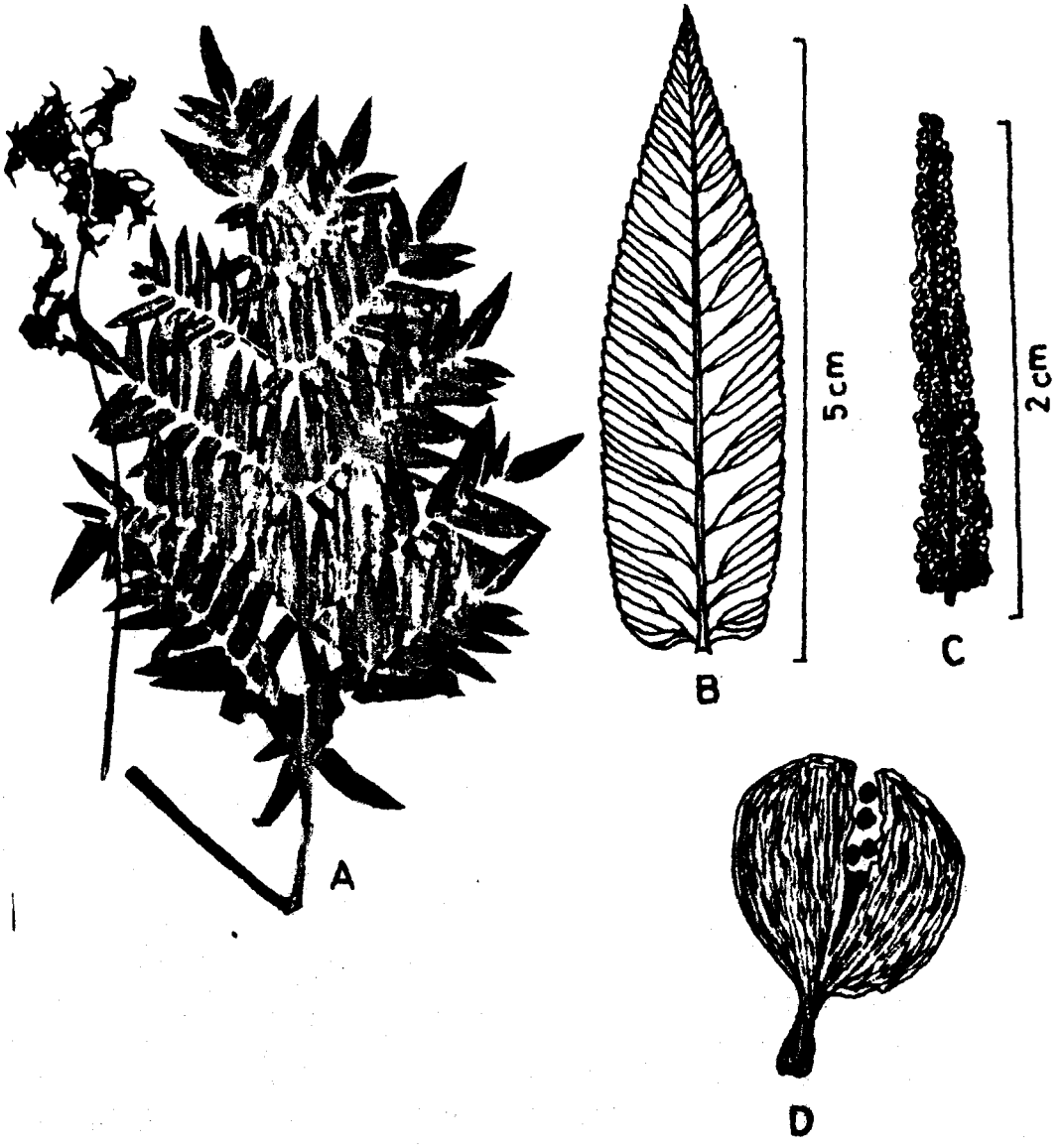


Plate 21: Osmunda regalis Linn. A - Habit; B - sterile pinnule; C- fertile pinnule; D - sporangium;

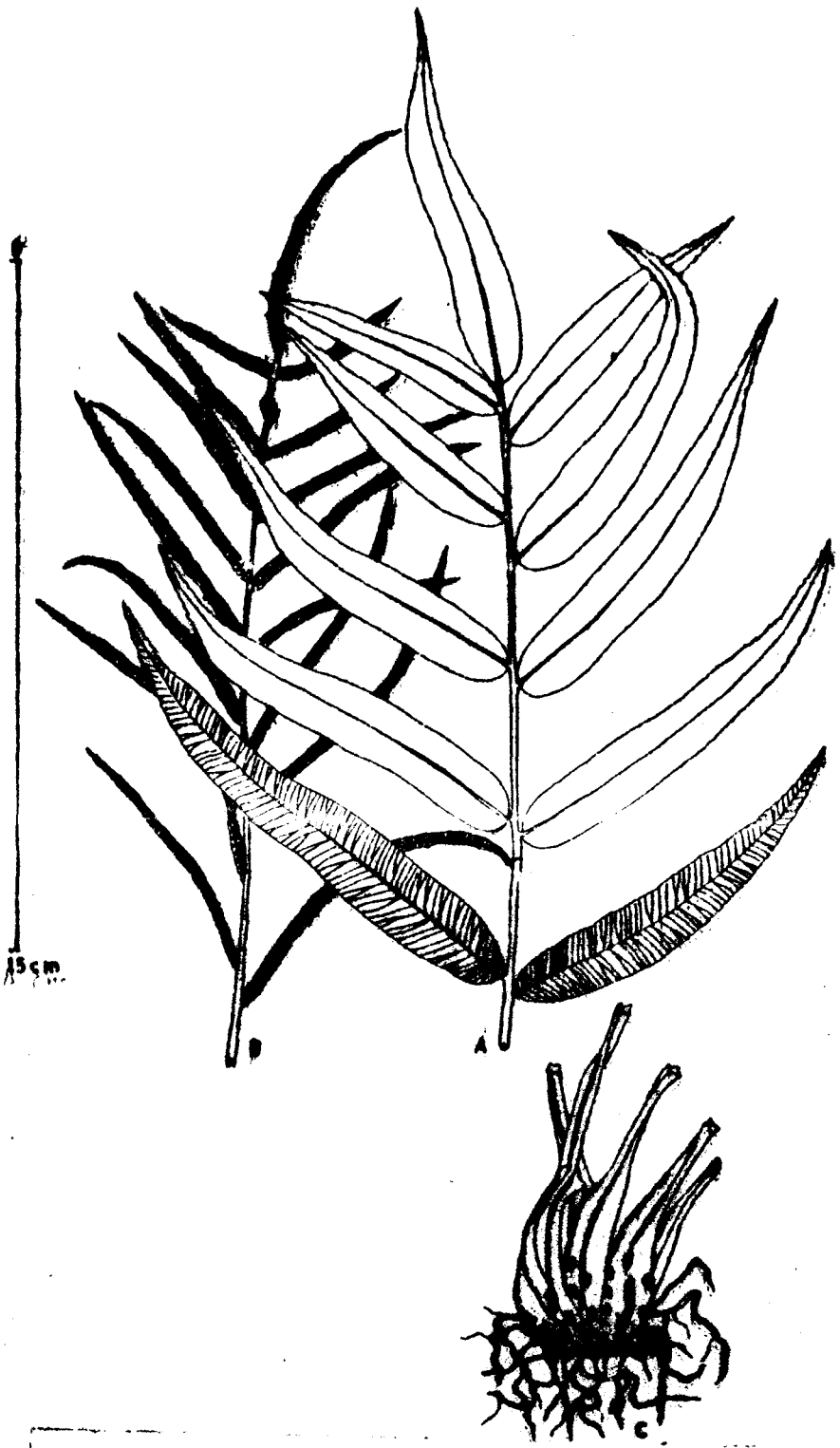


Plate 22: Pleocnemia antihelmia (Kuntze) Kott. A - Sterile frond; B - fertile frond; C - rhizome.

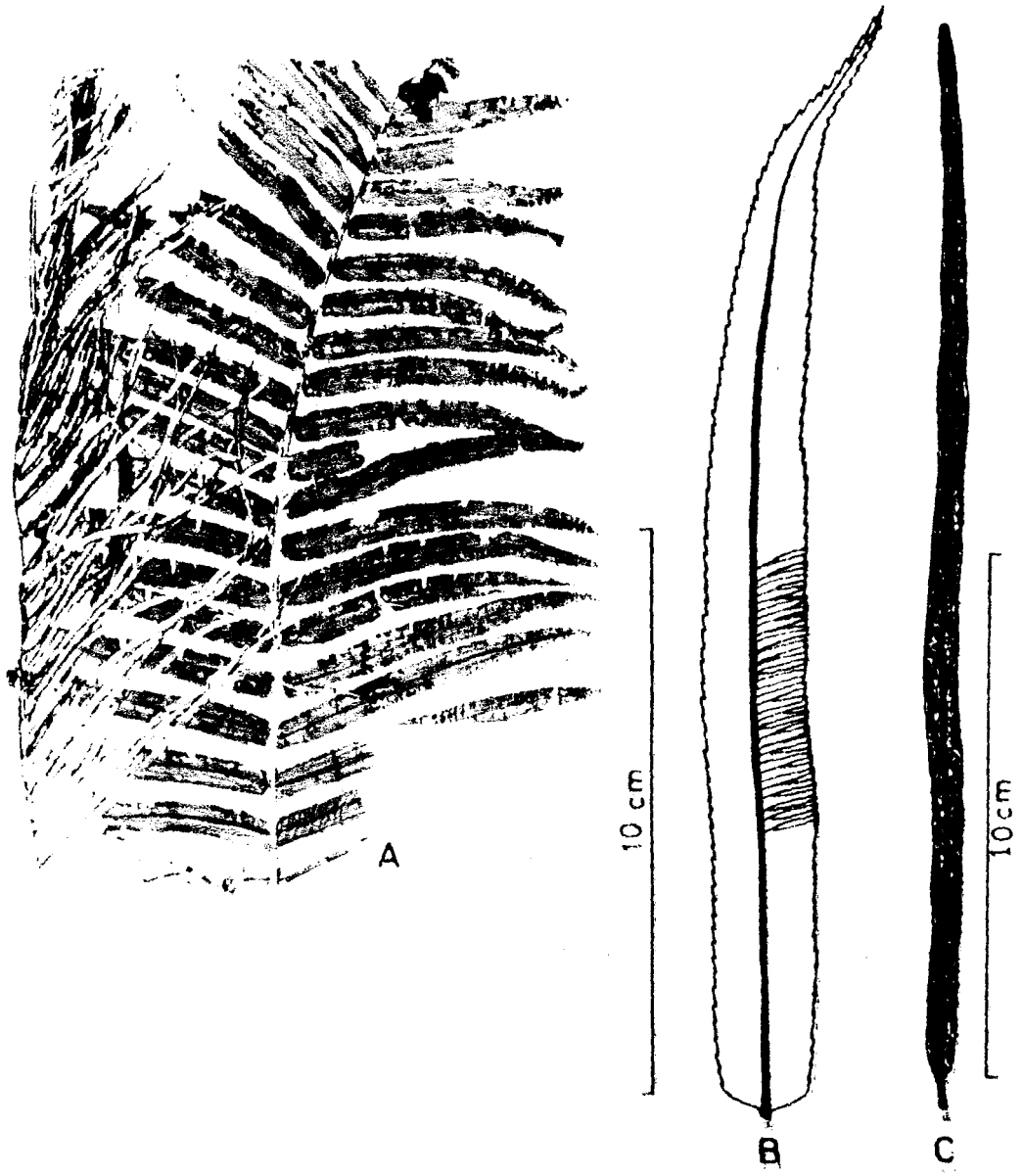


Plate 23: Plagiogyria gigantea Ching A - Habit; B - sterile pinna C - fertile pinna.

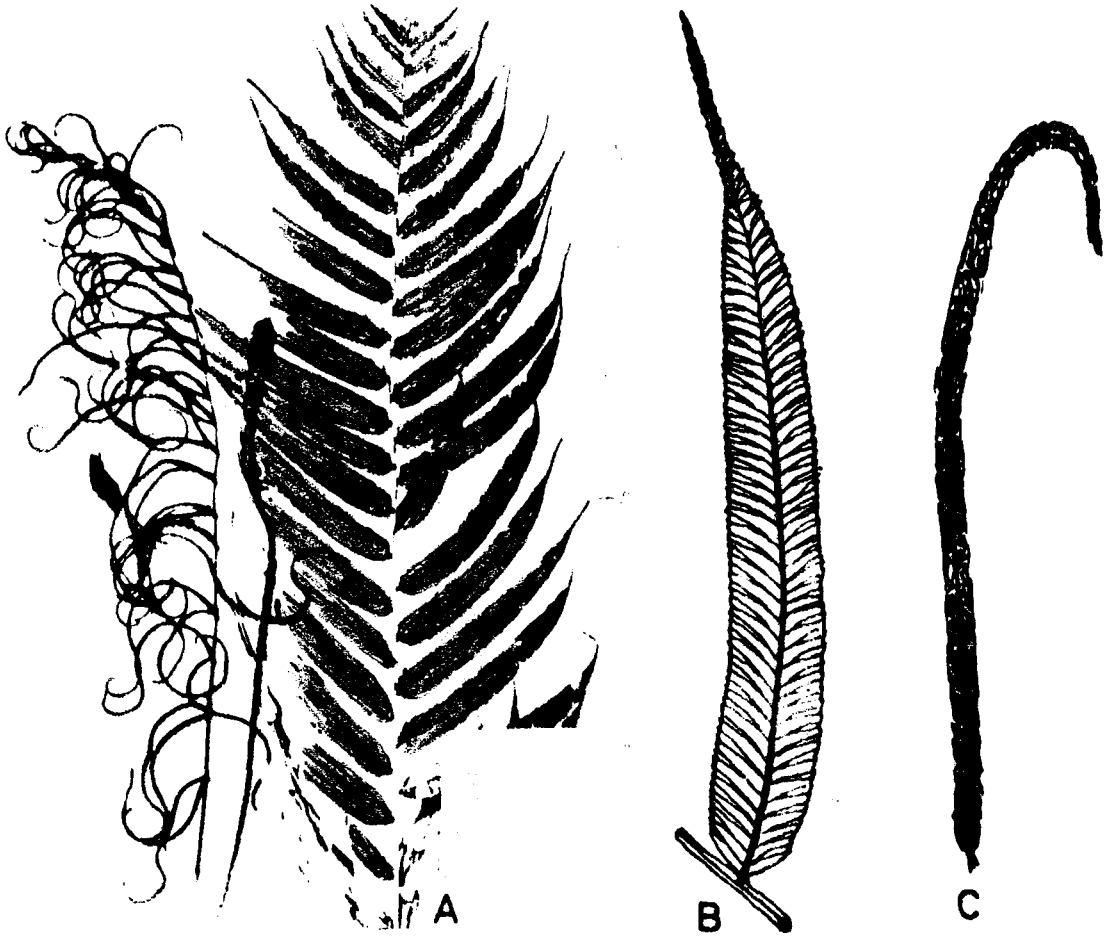


Plate 23A: Plagiogyria scandens Mett. A - Habit; B - sterile pinna; C - fertile pinna.

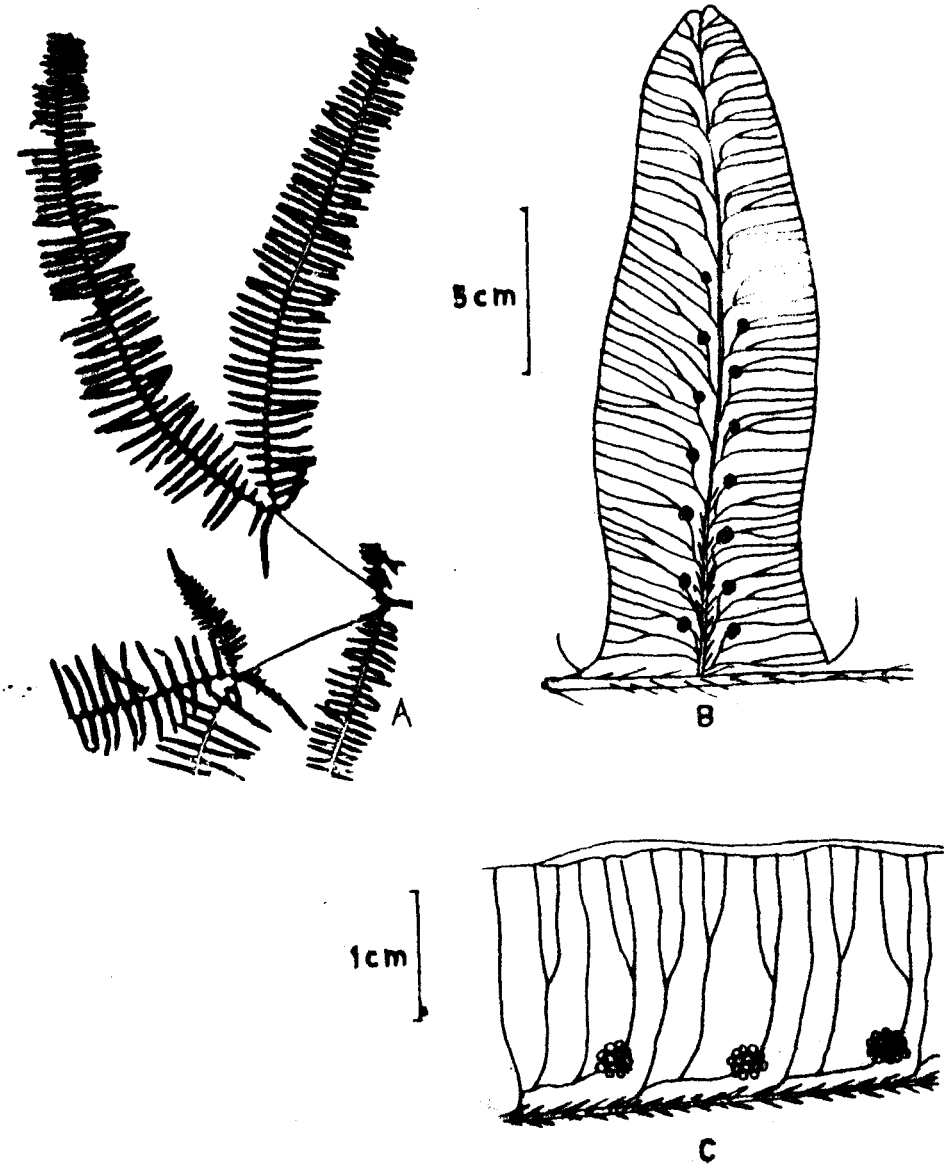


Plate 24: Dicranopteris linearis (Burm.f.) Underwood var. altissima Holttum A - Habit B - pinnule; C - portion of pinnule enlarged showing arrangement of sori.

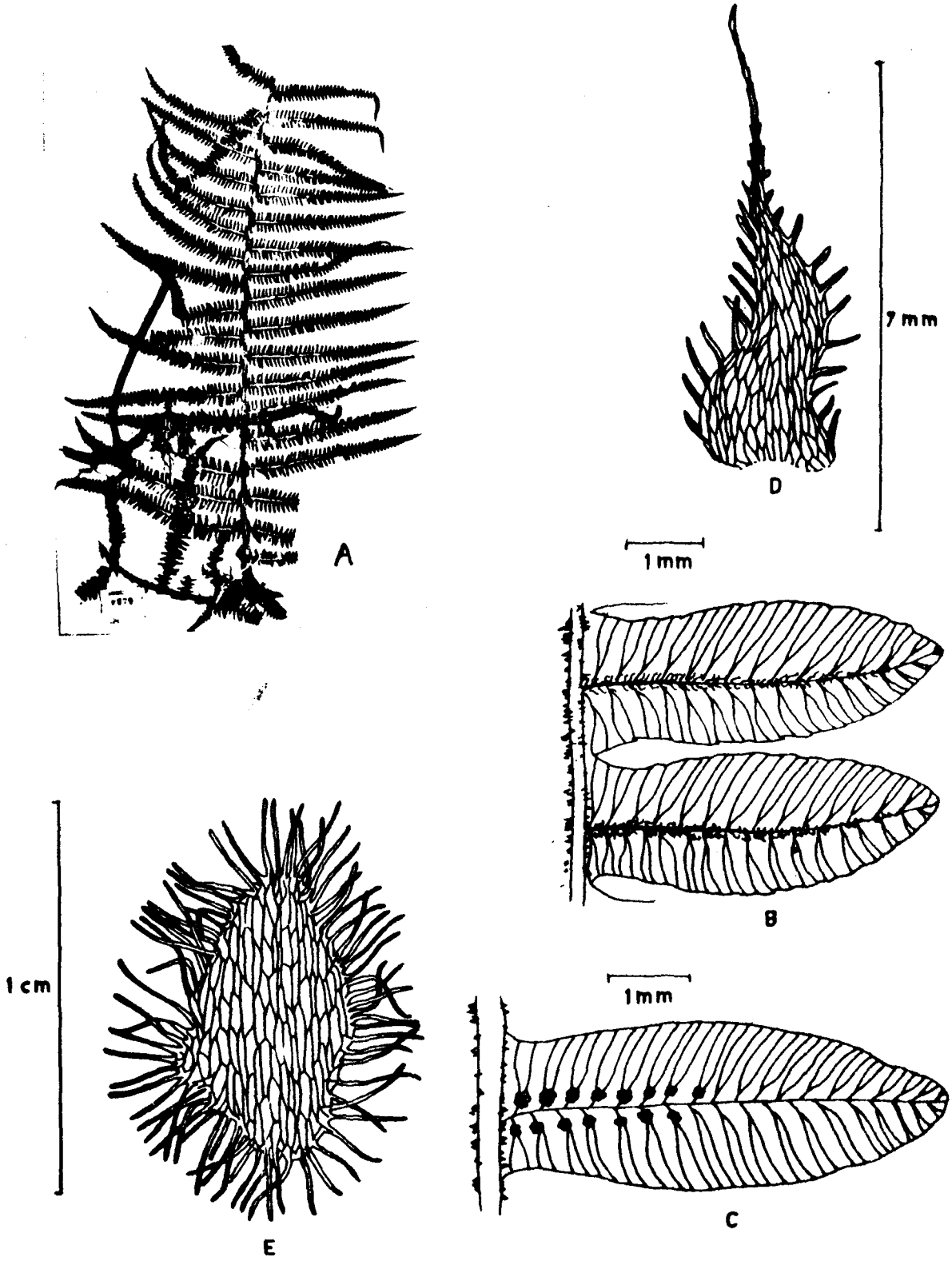


Plate 25: Gleichenia longissima Blume A - Habit; B & C - pinnules enlarged showing the arrangement of sori veins; D - rhizome scale; E - stipe scale; F - costae.

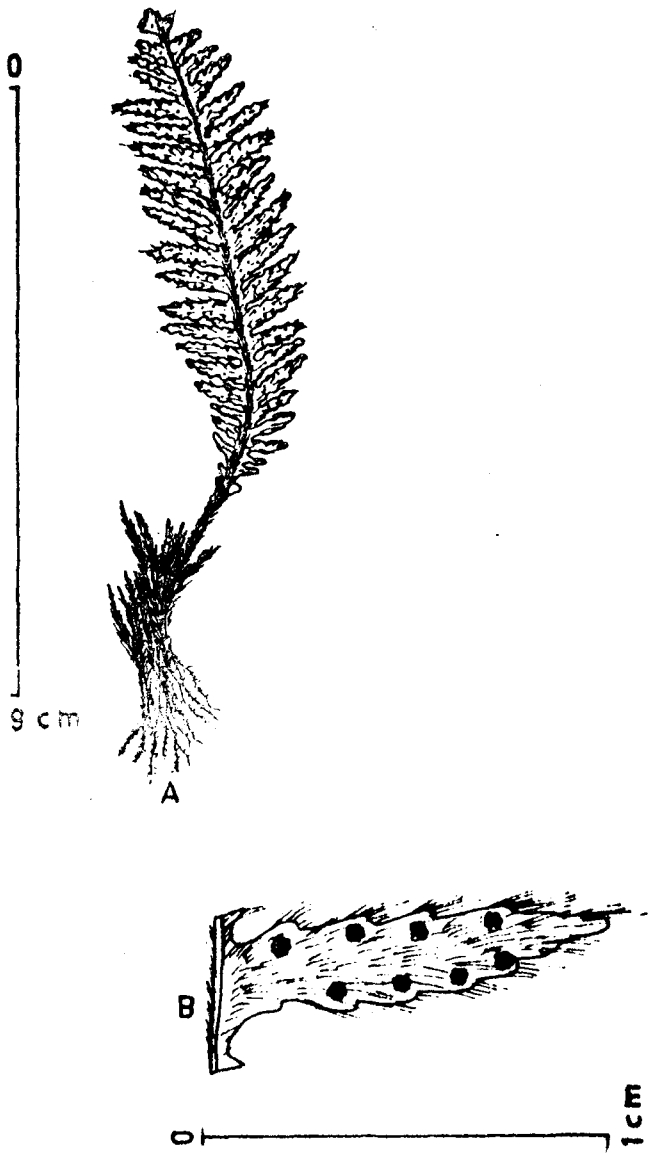


Plate 26: Ctenopteris subfalcata (Blume) Kuntze A - Habit; B - fertile pinna enlarged.

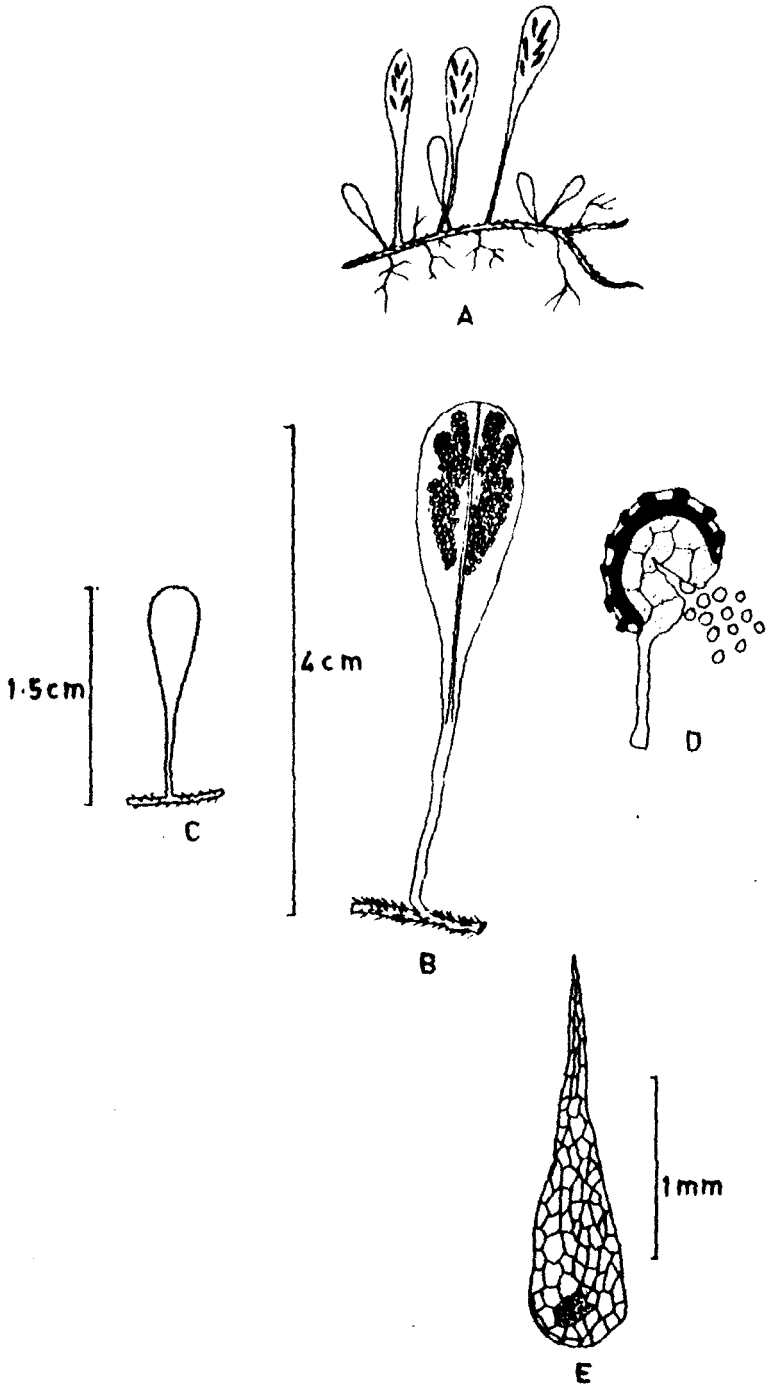


Plate 27 : Lxogramme grammitoides (Bk.) C.Chr. A - Habit; B - fertile frond; C - sterile frond; D - sporangium; E - rhizome scale.

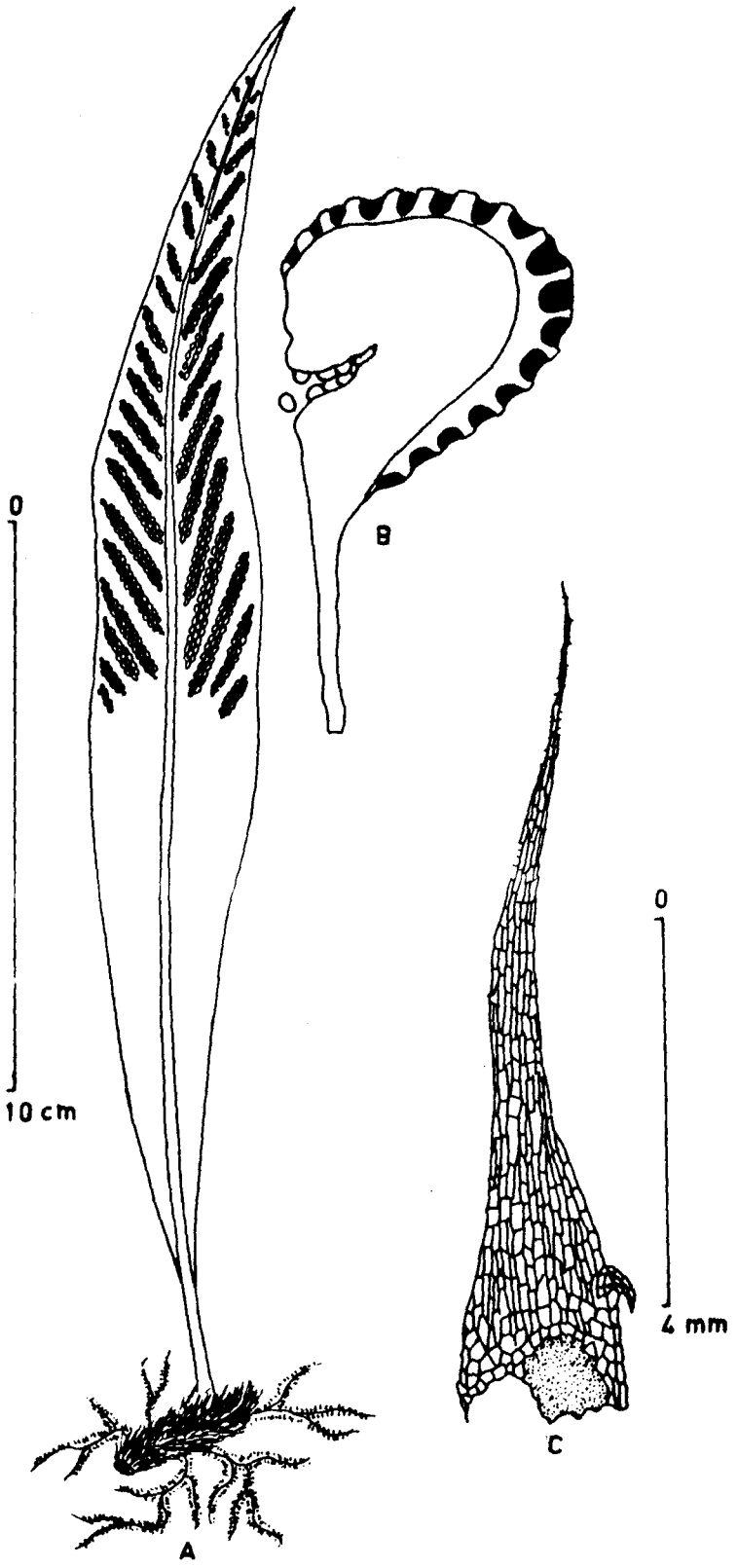


Plate 28: Loxogramme involuta (D.Don) Presl. A - Habit; B - sporangium; C - rhizome scale.

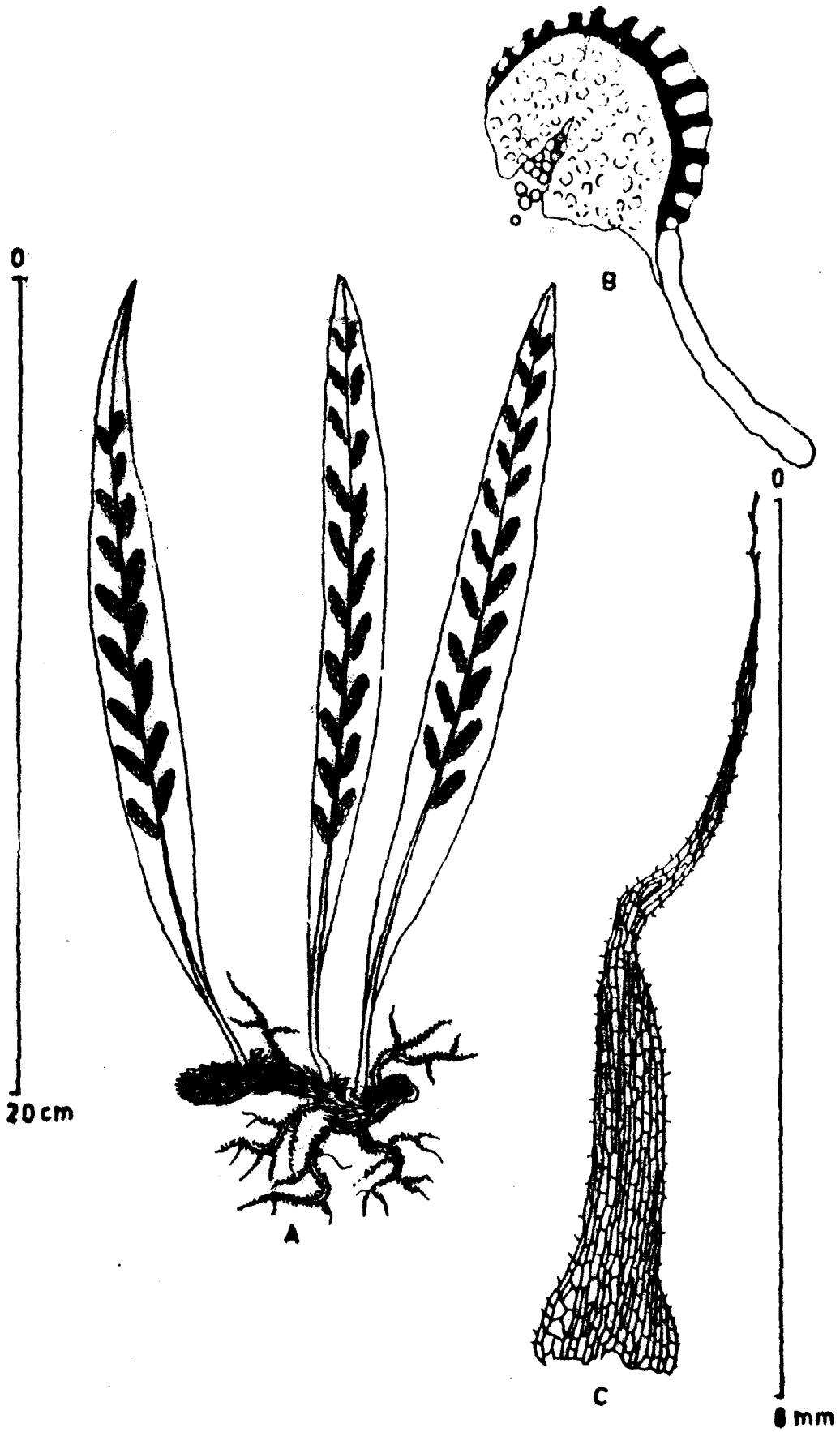


Plate 28A : Loxogramme lanceolata (Sw.) Presl. A - Habit; sporangium; C - rhizome scale.

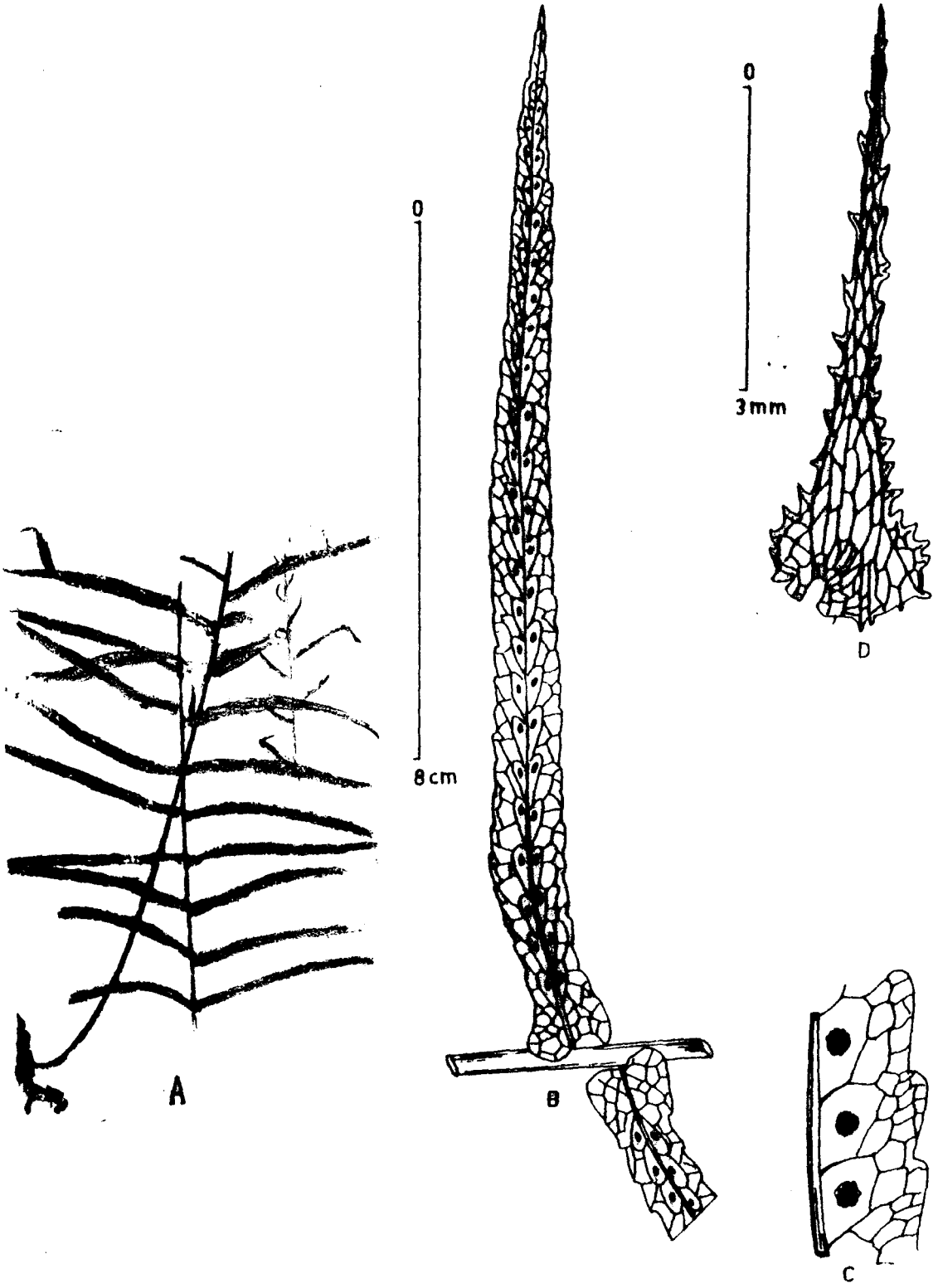


Plate 29: Polypodium argutum Wall. ex Hook. var. longifolia, var. nov. A - Habit; B & C - fertile pinna showing venation and sori; D - rhizome scale.

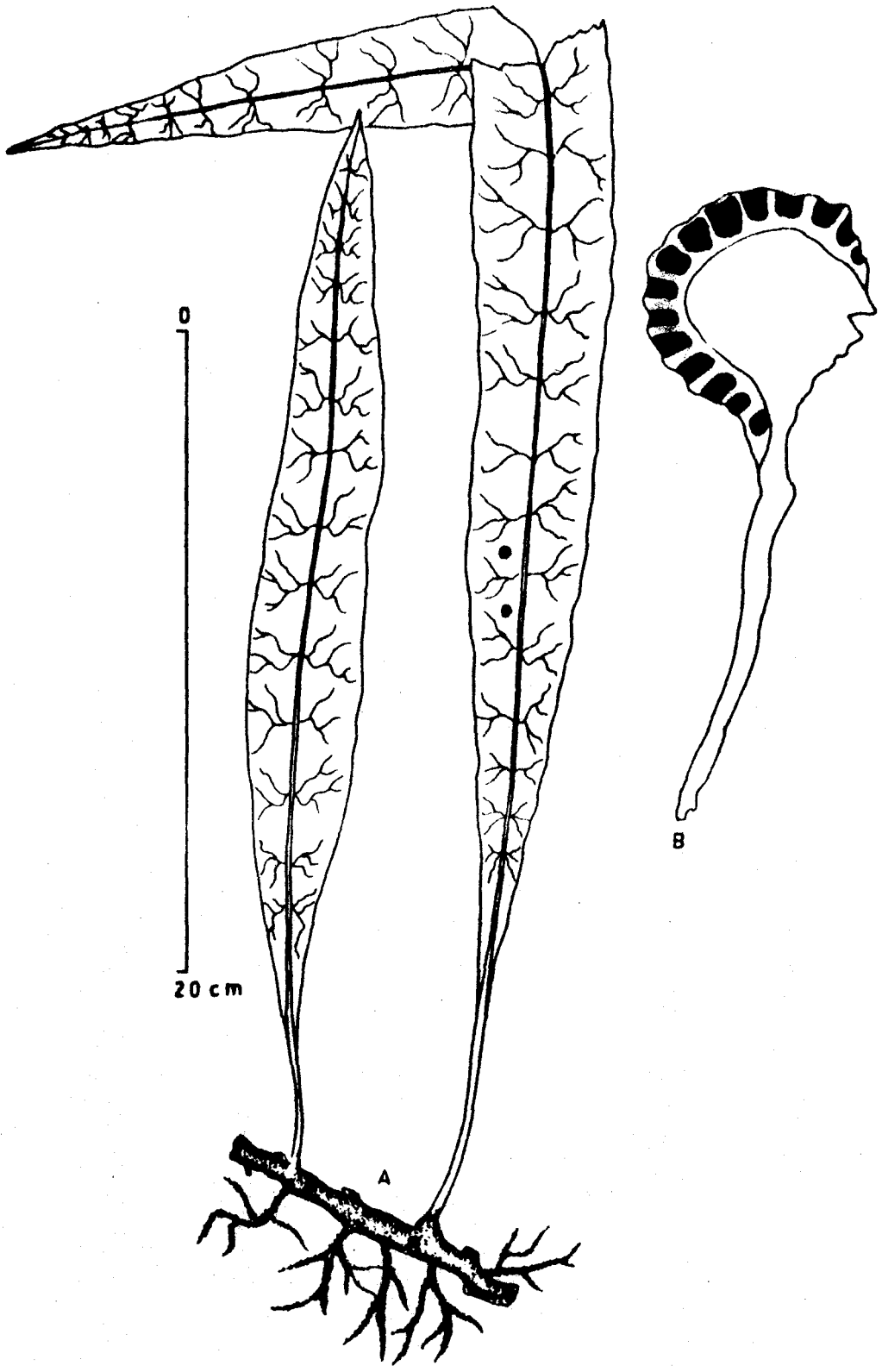


Plate 30 : Macrothelypteris torresiana (D.Don) Tagawa A - Habit; B - sporangium.

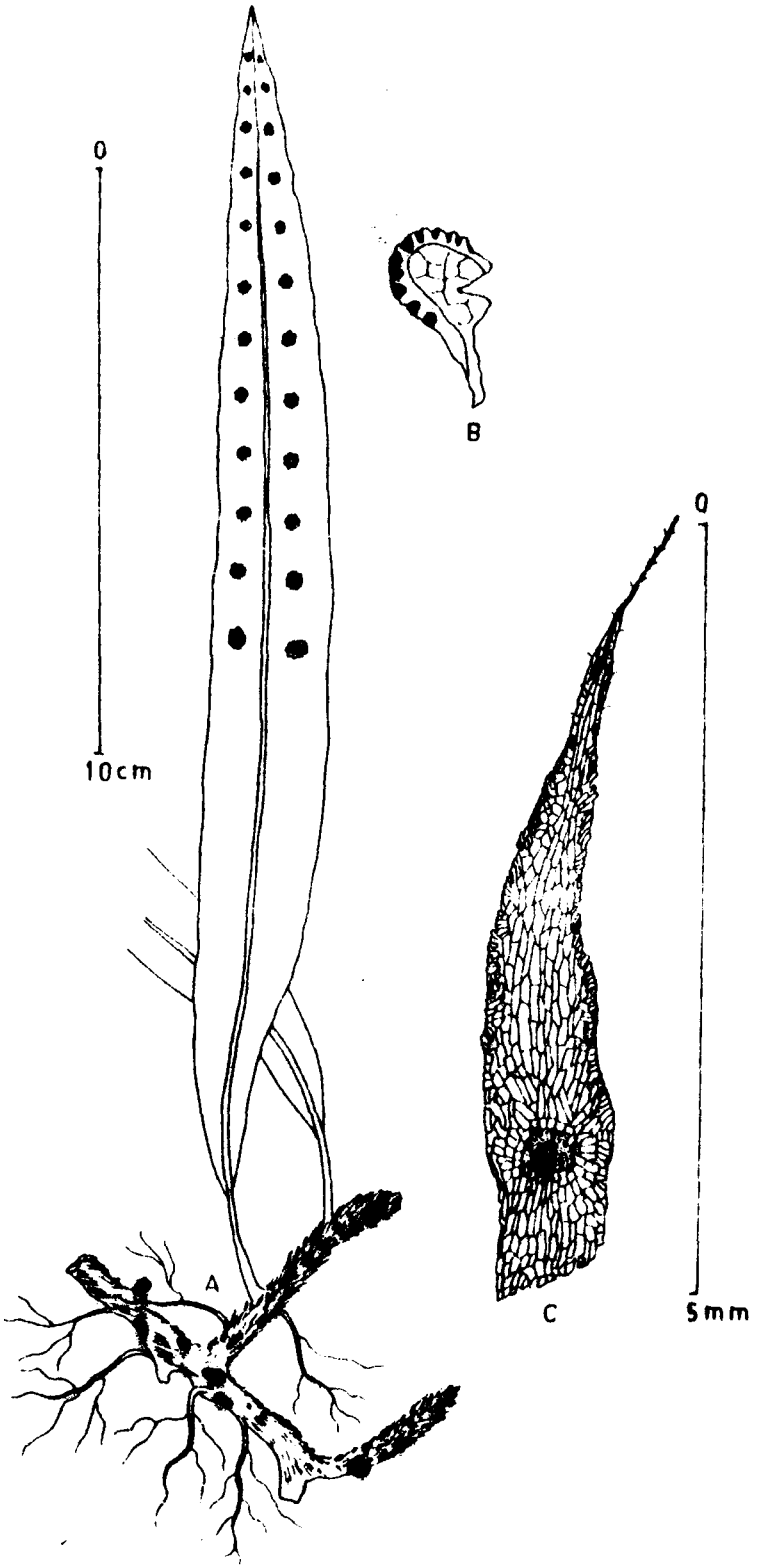


Plate 31: Lepisorus excavatus (Bory) Ching A - Habit;
B - sporangium; C - rhizome scales

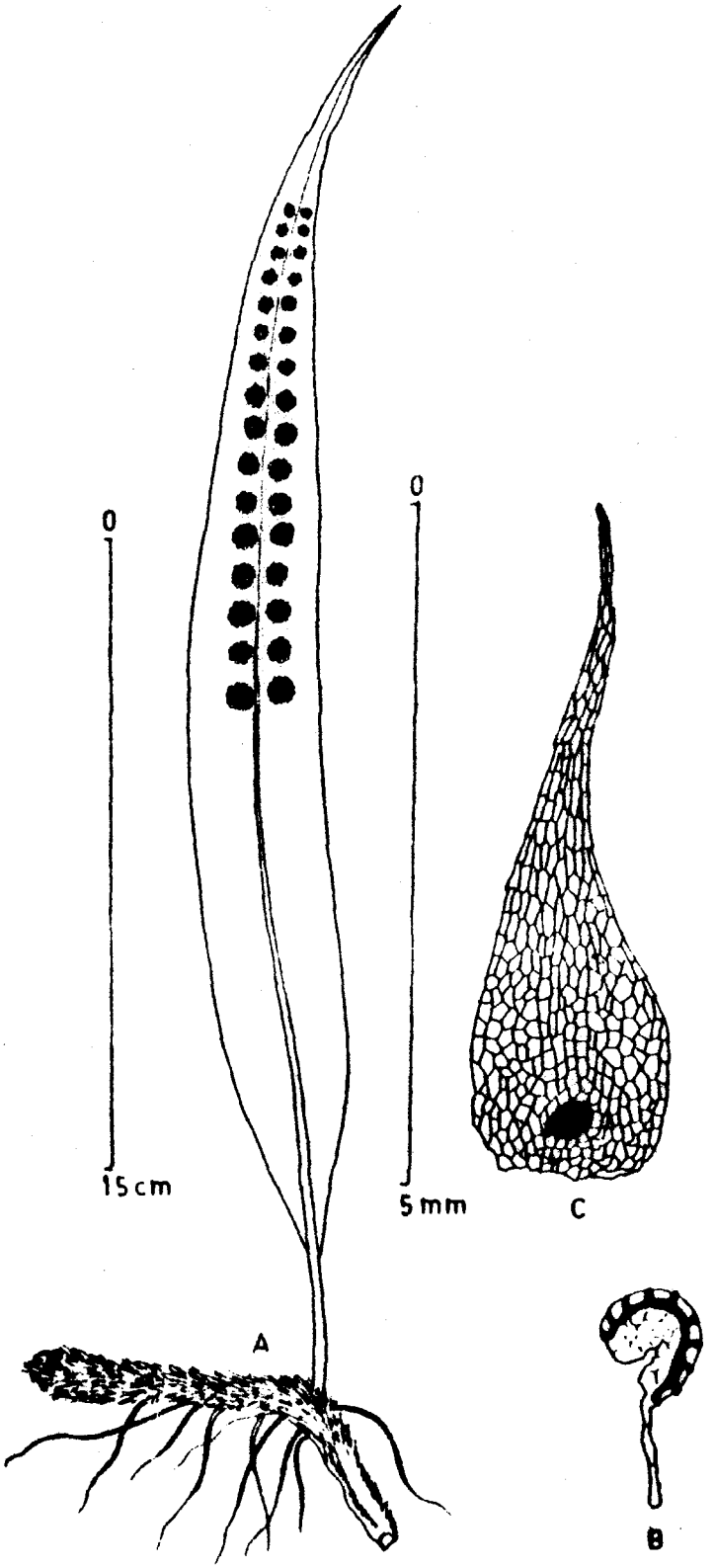


Plate 32: Lepisorus kamnyaoii (Mehra) Bir A - Habit; B - sporangium; C - rhizome scale.

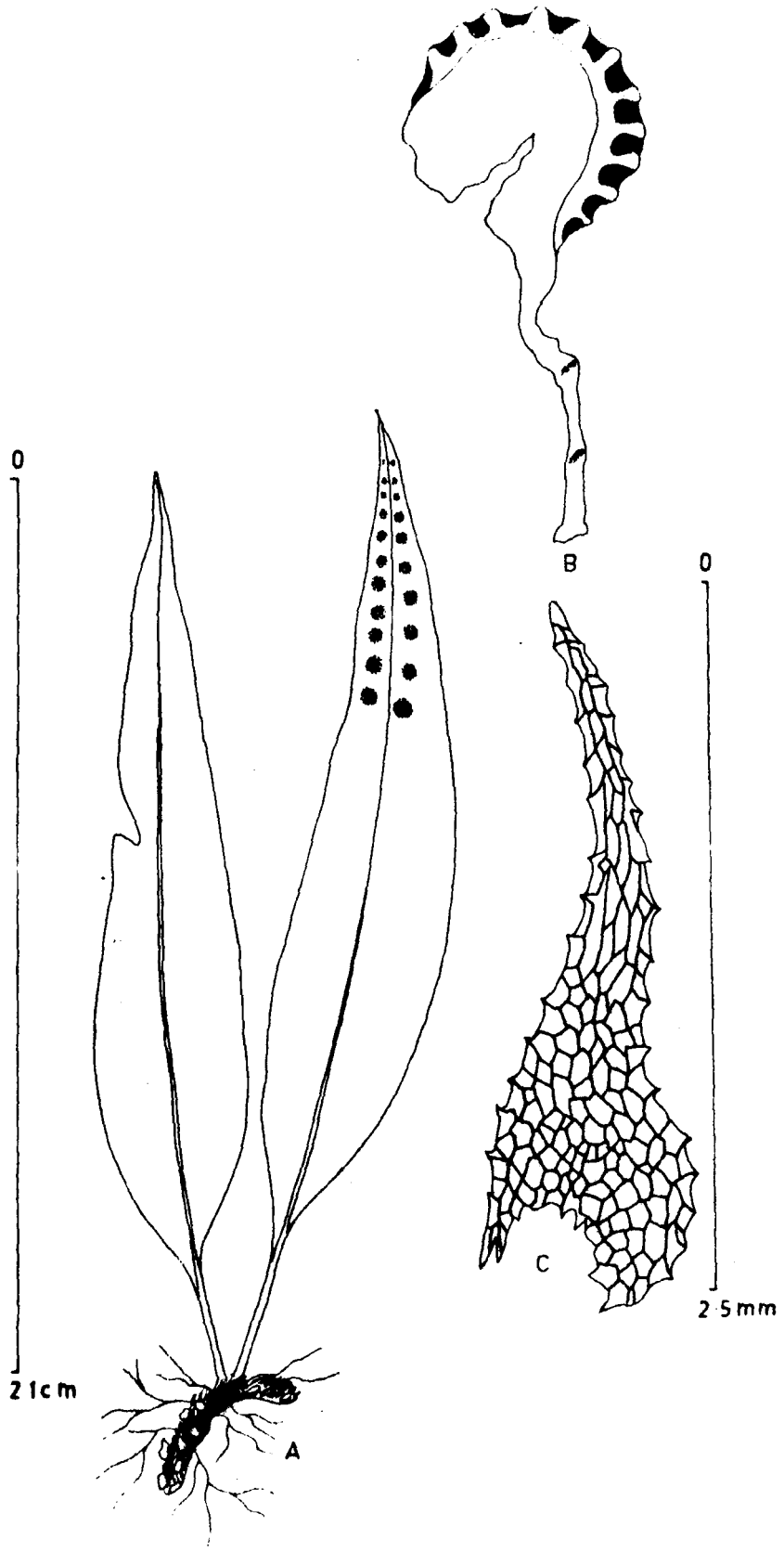


Plate 33: Leptochorus sordidus (C.Chr.) Ching A - Habit; B - sporangium; C- rhizome scale.

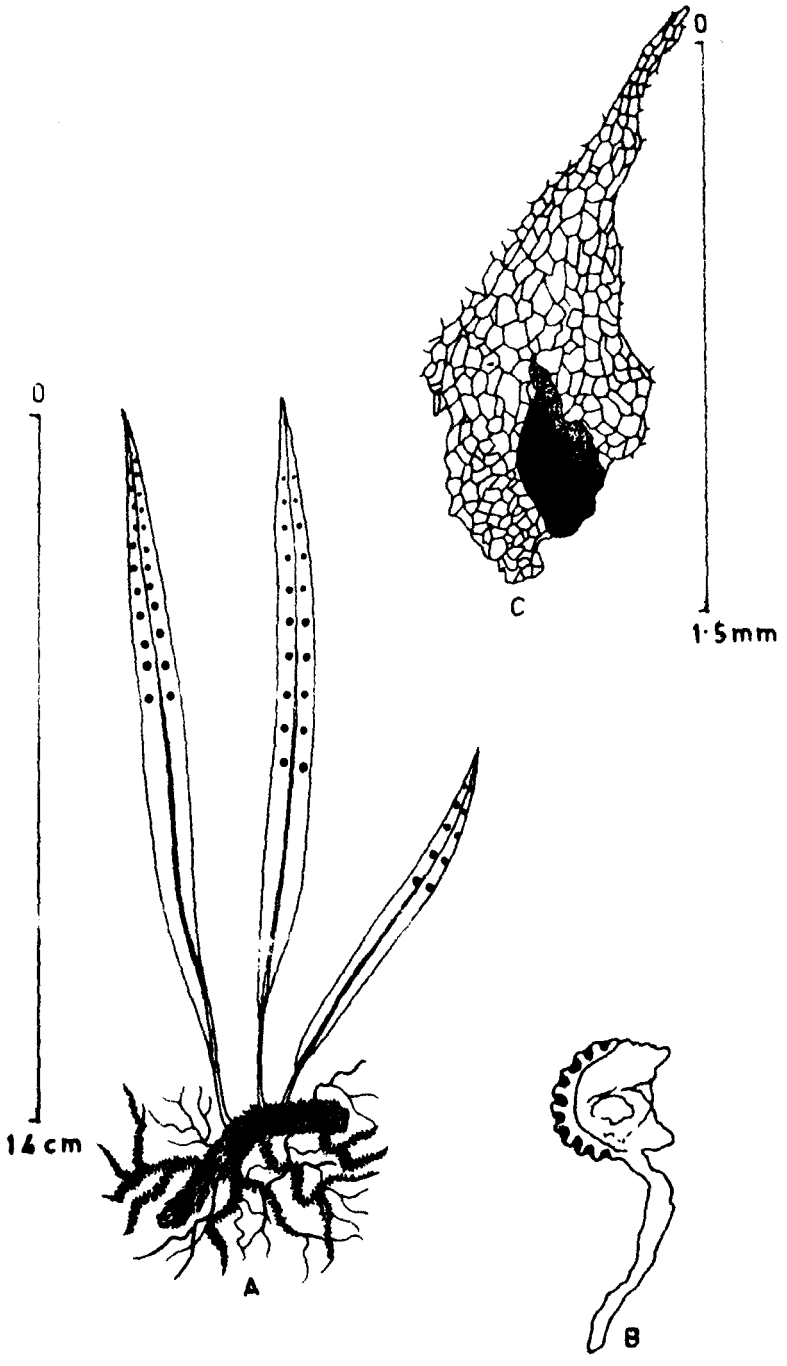


Plate 34: <u>Lepisorus nasuriensis</u> (Regal et Maack) Ching
A - Habit; B - sporangium; C - rhizome scale.

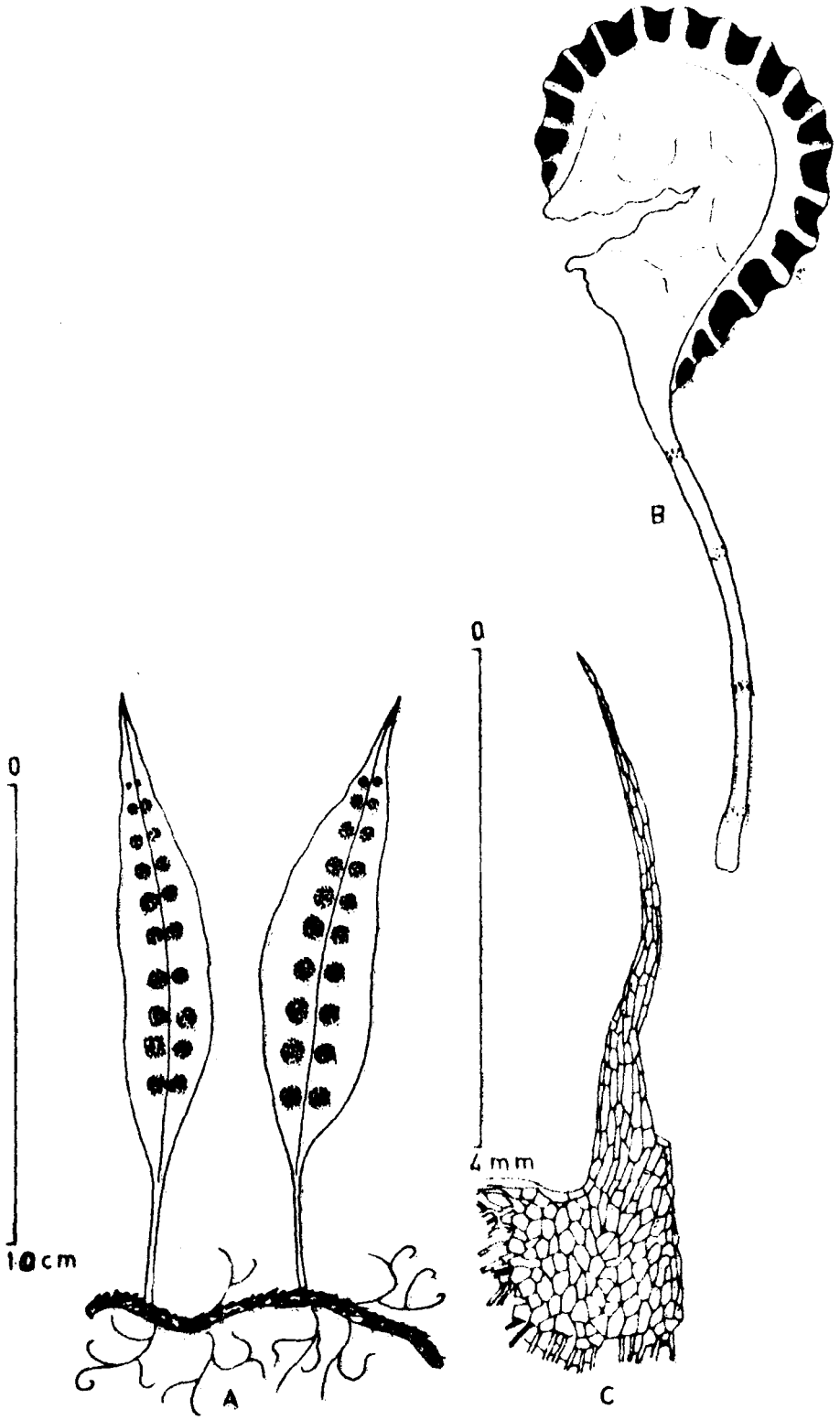


Plate 3 *Leptochilus rostratus* (Hook.) Ching A- Habit; B - sporangium; C - rhizome scale.

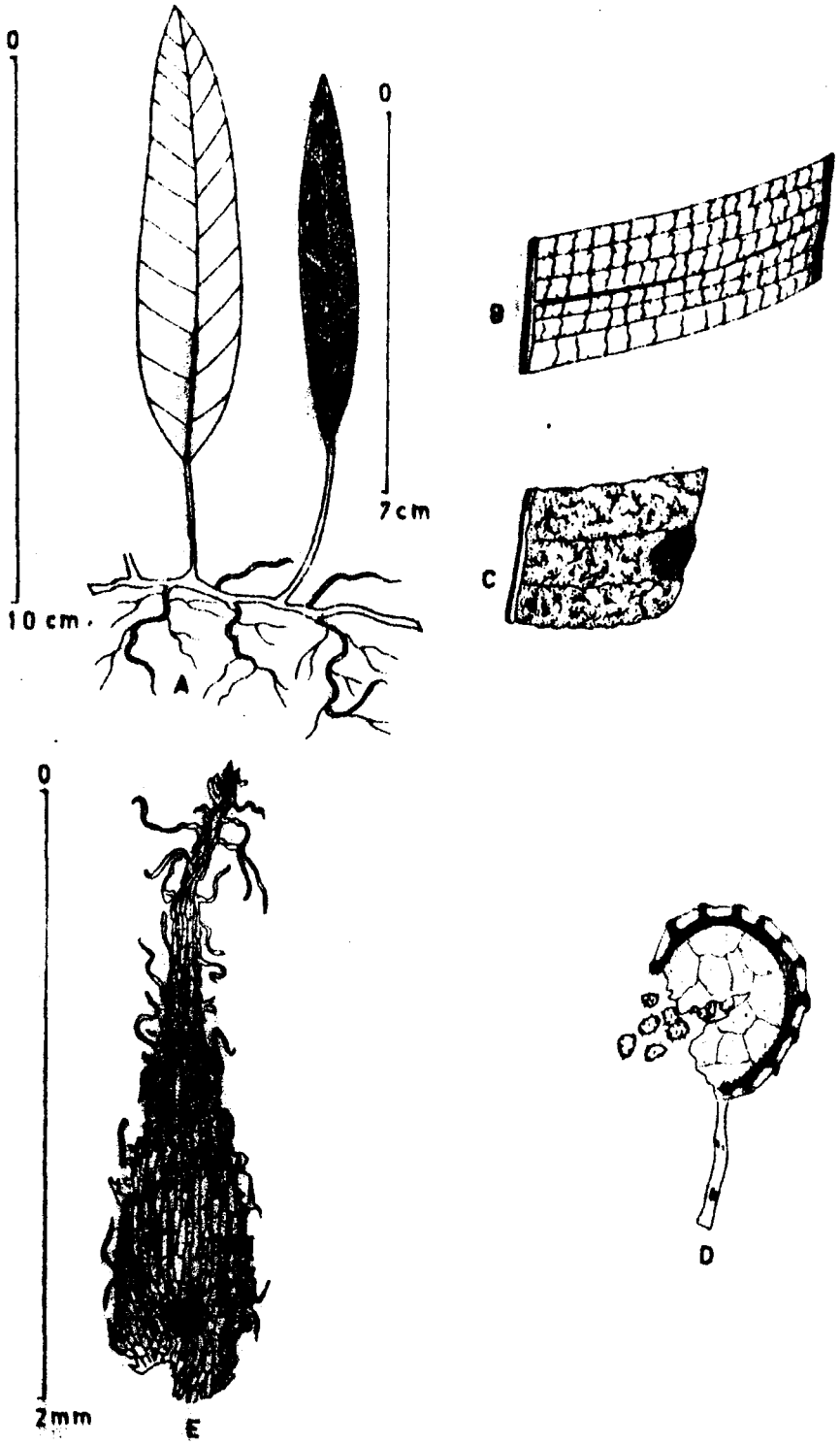


Plate 35: Pyrrosia lingua (Thunb.) Farewell. A - Habit; B - sterile frond showing venation; C - fertile frond with sori; D - sprangium; E - rhizome scale.

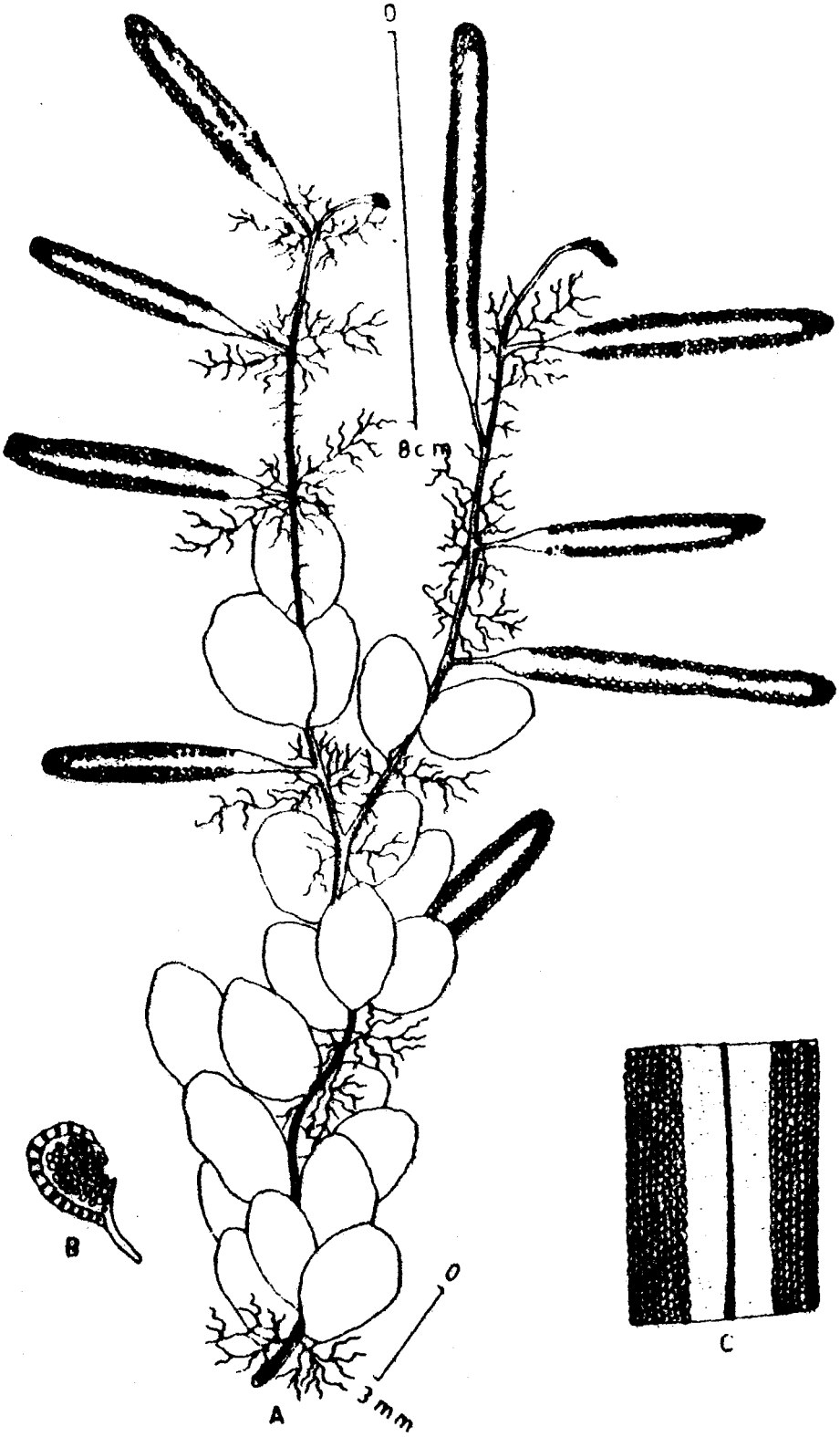


Plate 36: Drymoglossum heterophyllum (Linn.) Trimen
A - Habit; B - sporangium; C - a portion of fertile frond.

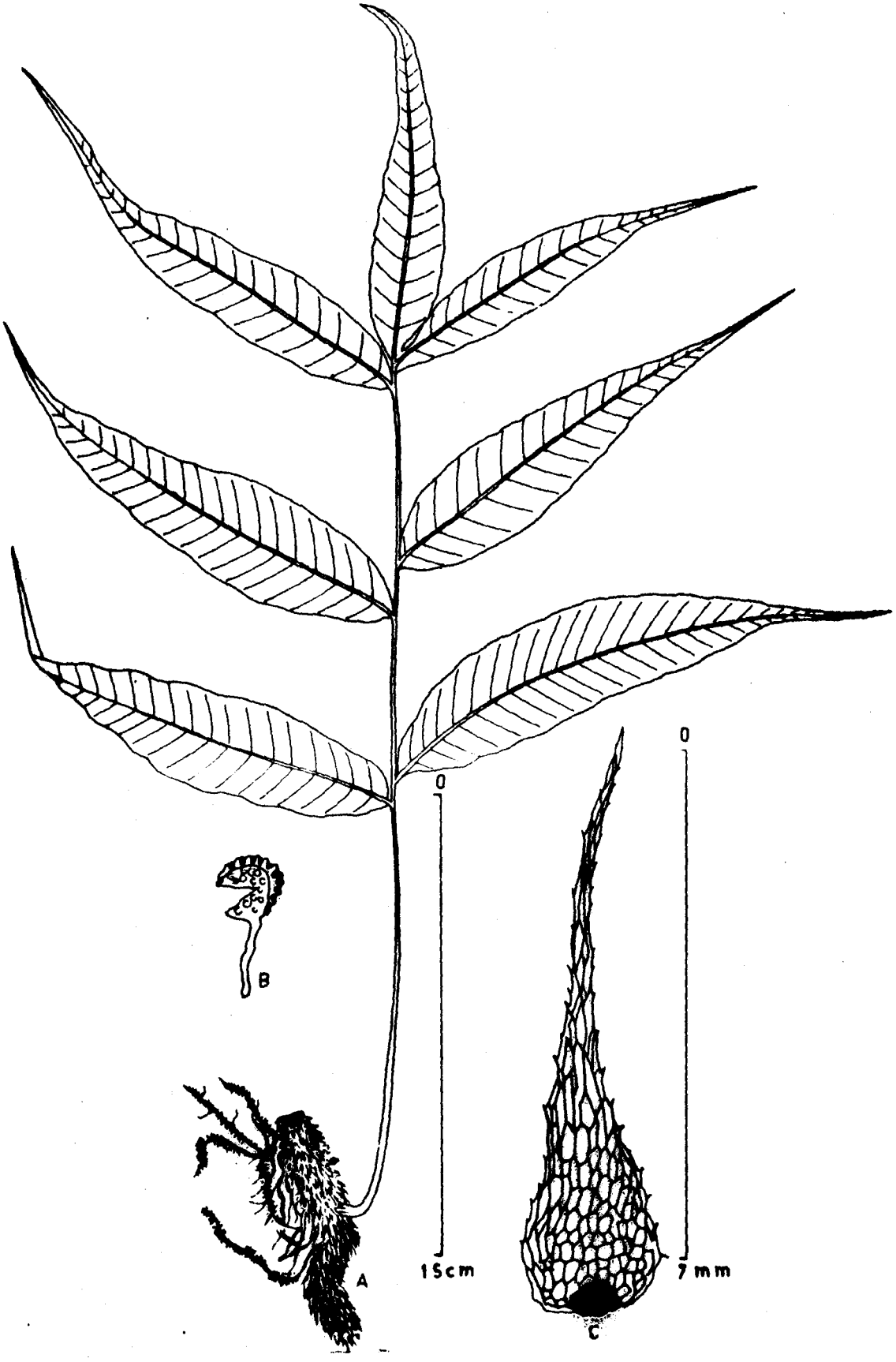


Plate 37: Arthromeris wallichiana (Spring) Ching A - Habit; B - sporangium; C - rhizome scale.

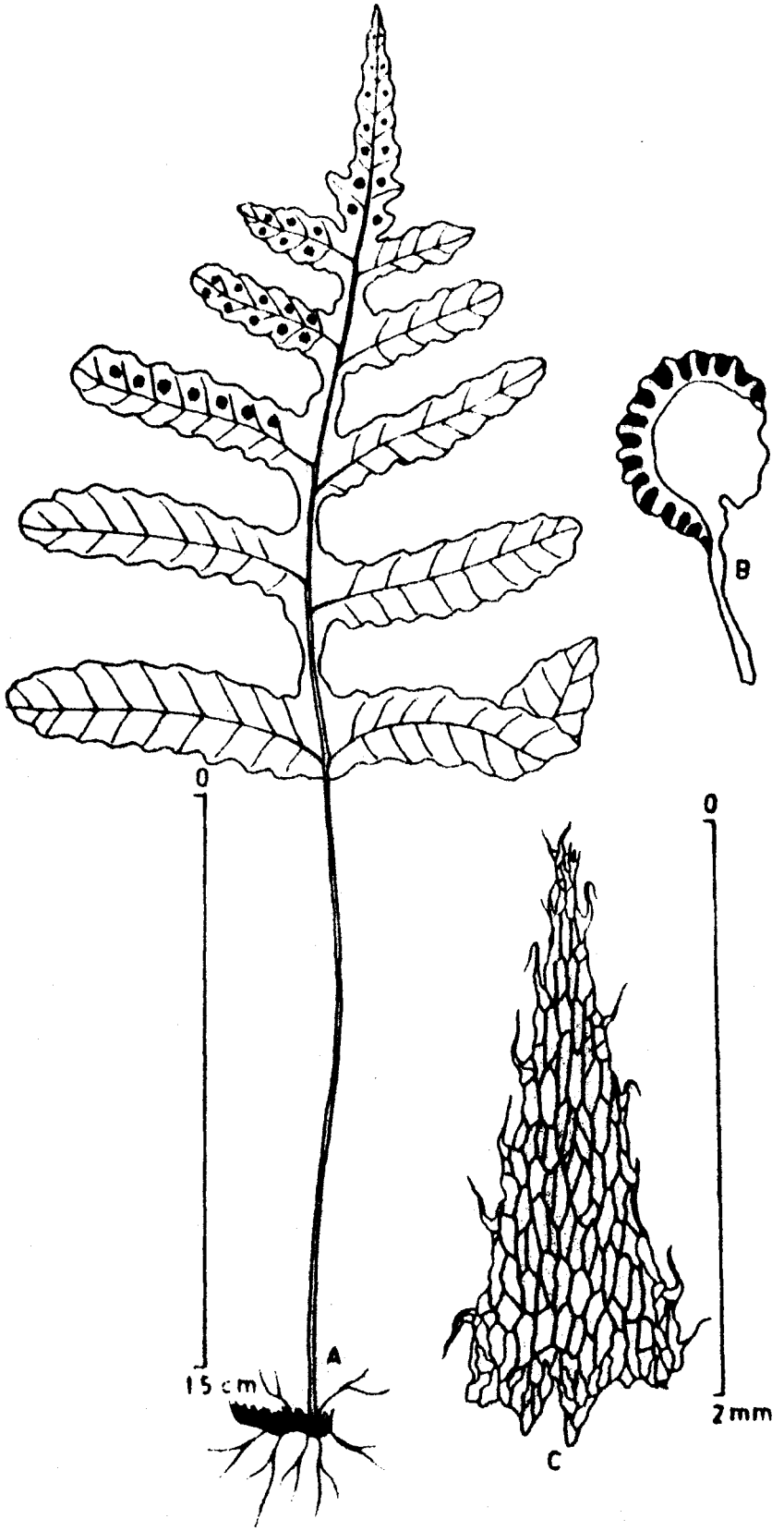


Plate 38: Cryptinus crenatopinnata (Clarke) Copel. A - Habit; B - sporangium; C - rhizome scale.

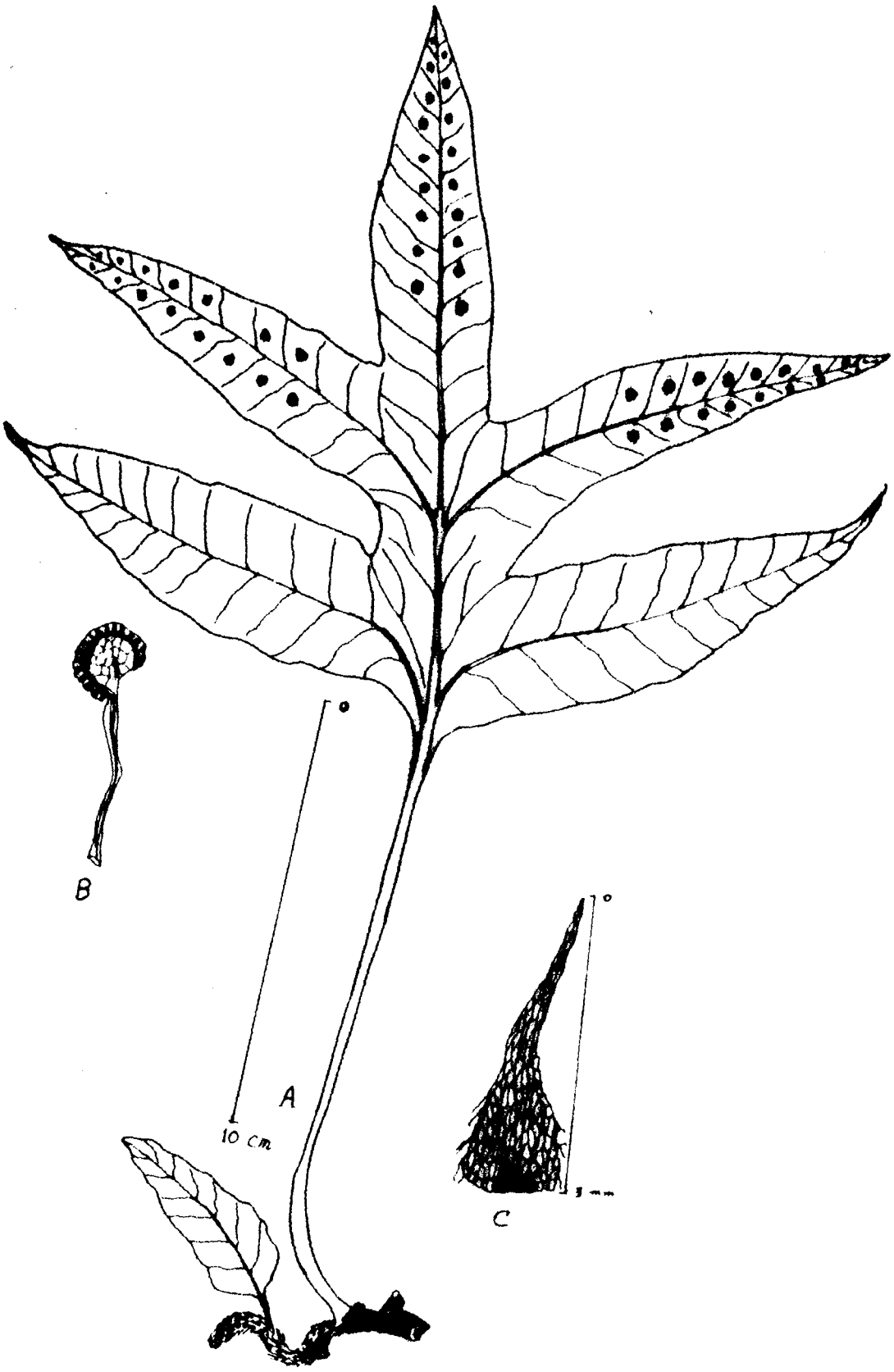


Plate39: Crypsinus nagalandensis sp. nov. A - Habit; B - sporangium; C - Rhizome scale.

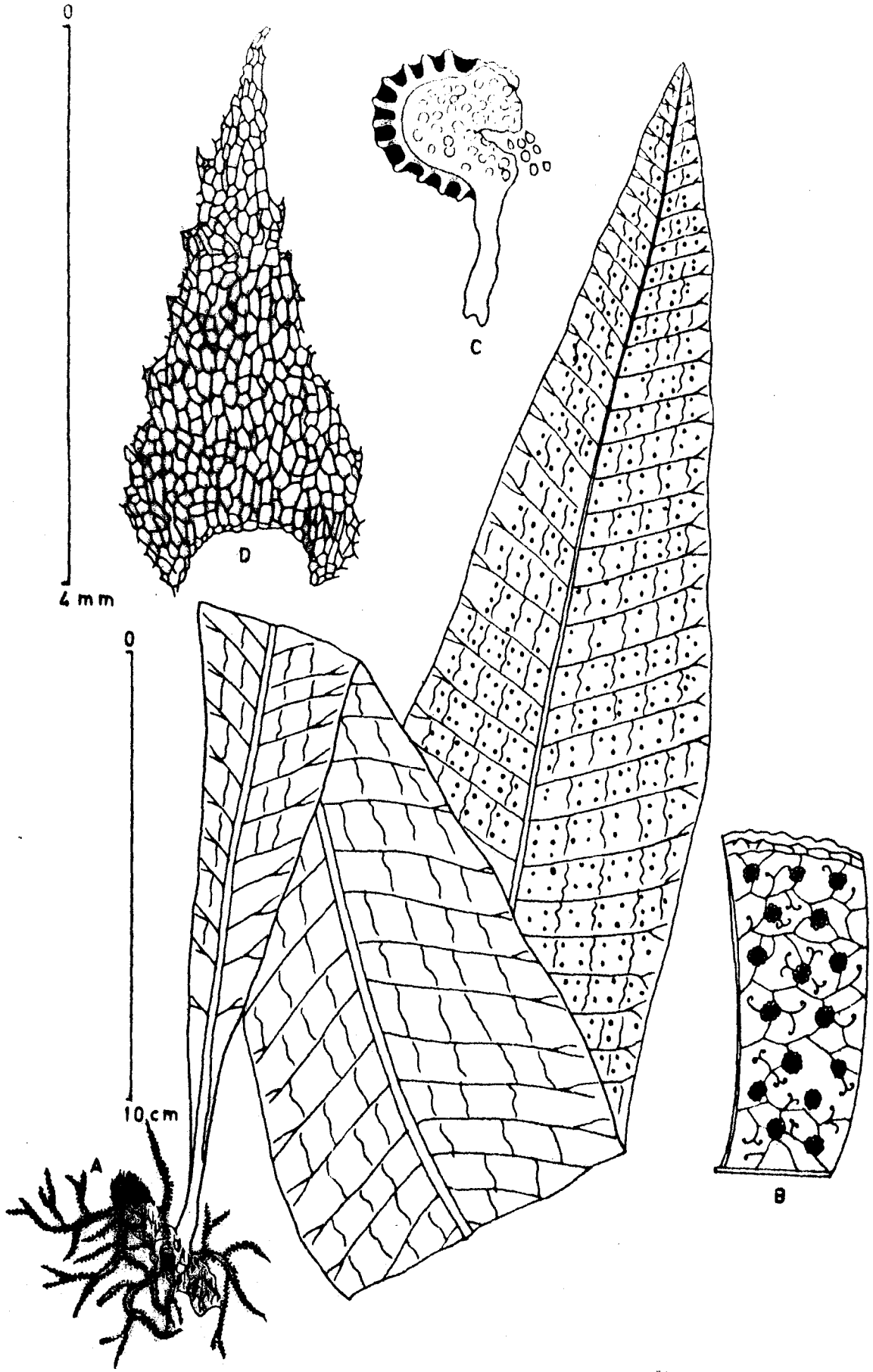


Plate 40: Microsorium membranaceum (D.Don) Ching A - Habit; B - a portion of frond with venation and sori; C - sporangium; D - rhizome scale.

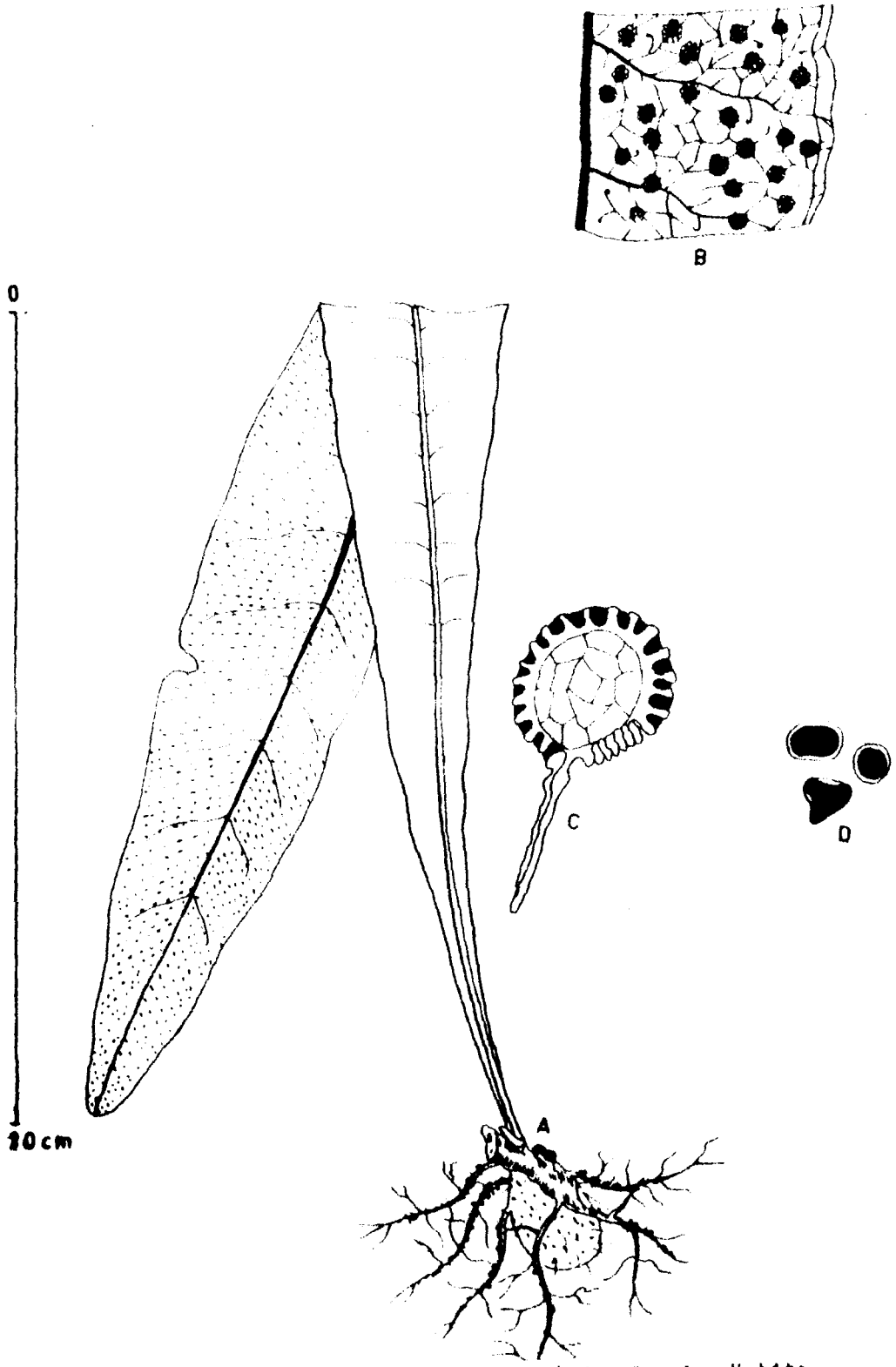


Plate 41: Microsorum punctatum (Linn.) Copel. A - Habit; B - a portion of fertile frond showing venation and sori; C - sporangium; D - spores.

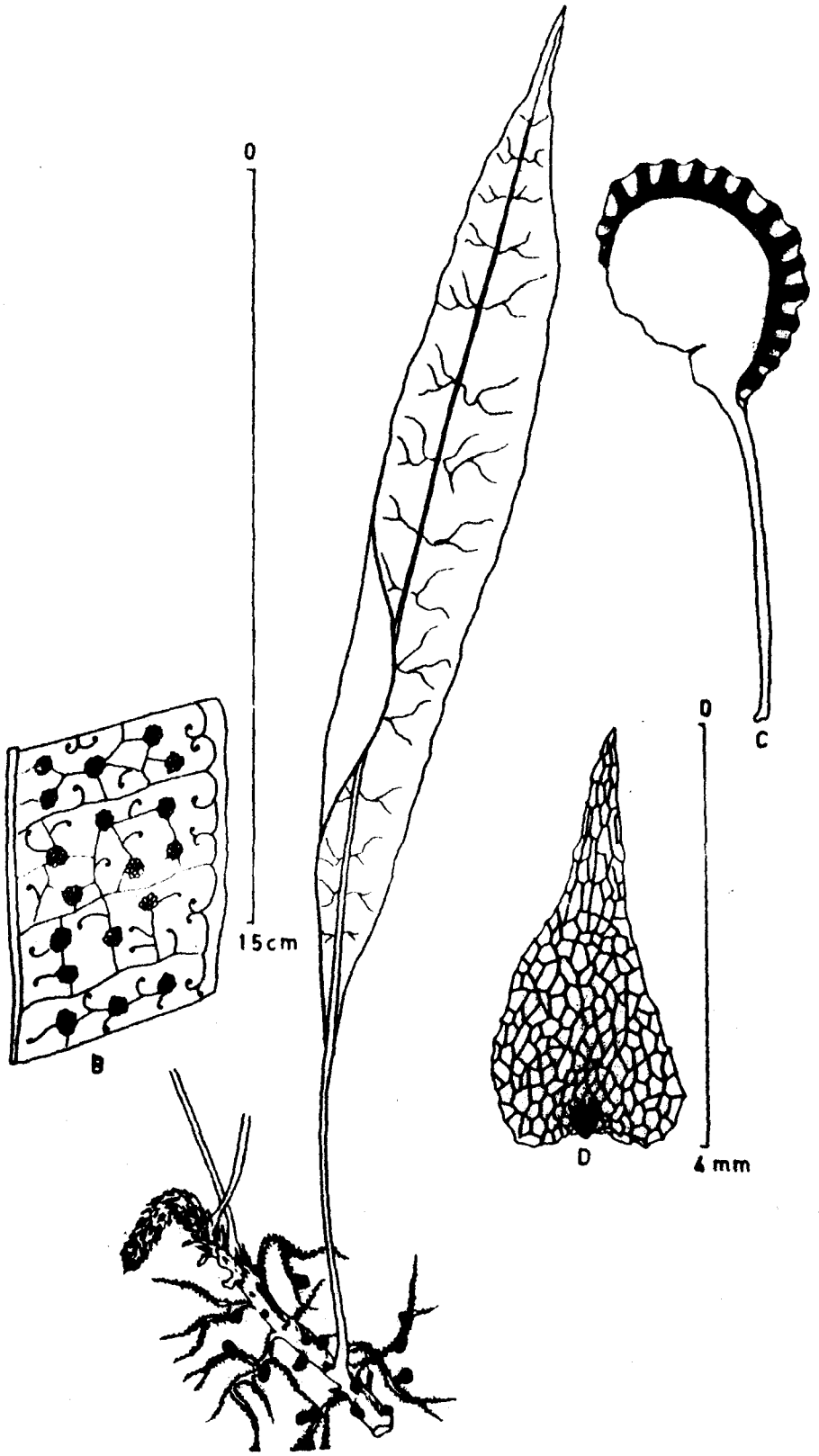


Plate 42: Microsorum superficiale (Blume) Ching A - Habit; B- a portion of frond showing venation and sori; C - sporangium; D - rhizome scale.

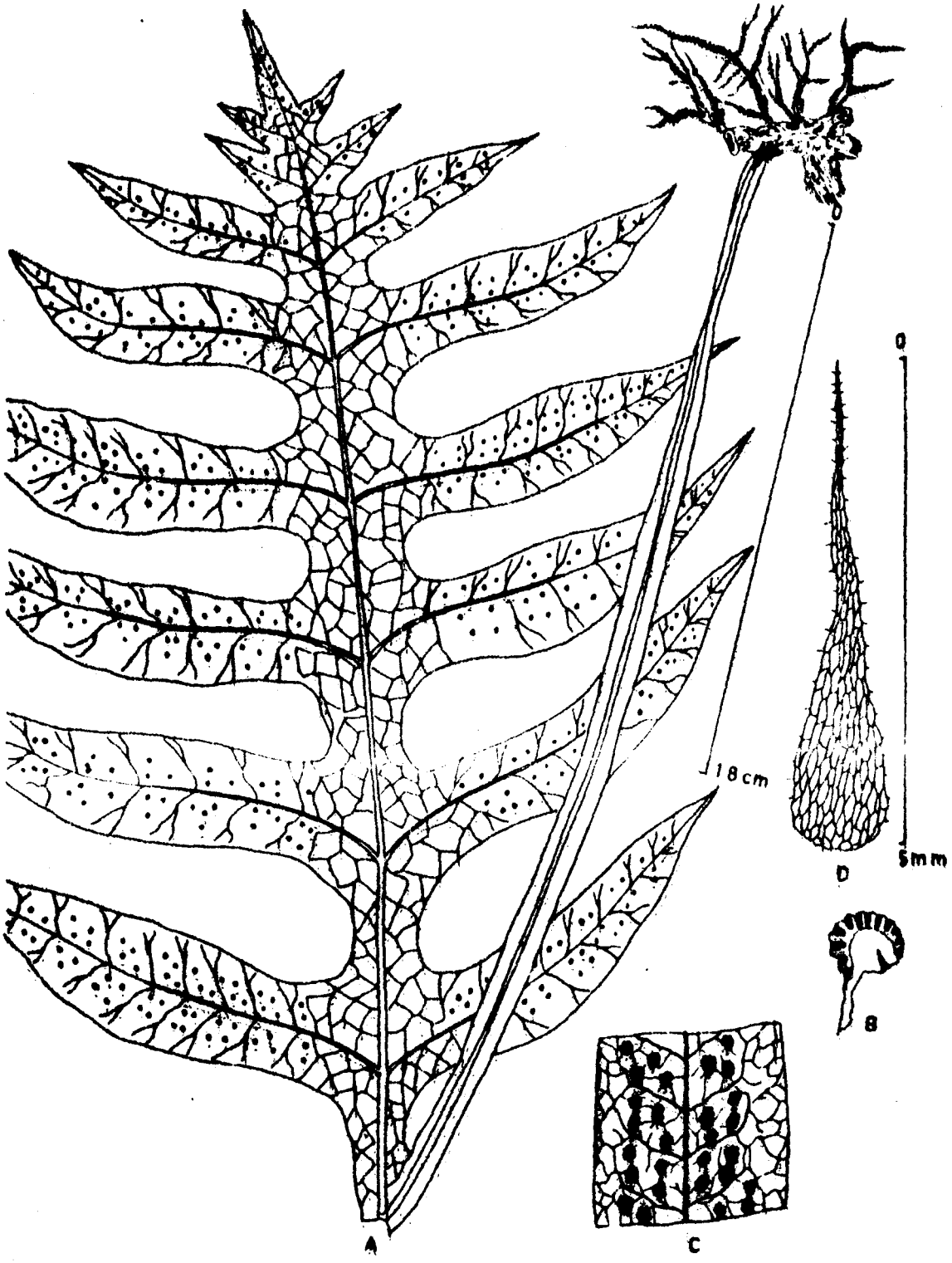


Plate 43: Kaulinia hanconkii (Baker) Mayar A - Habit; B - sporangium; C - a portion of pinna showing venation and sori; D - rhizome scale.

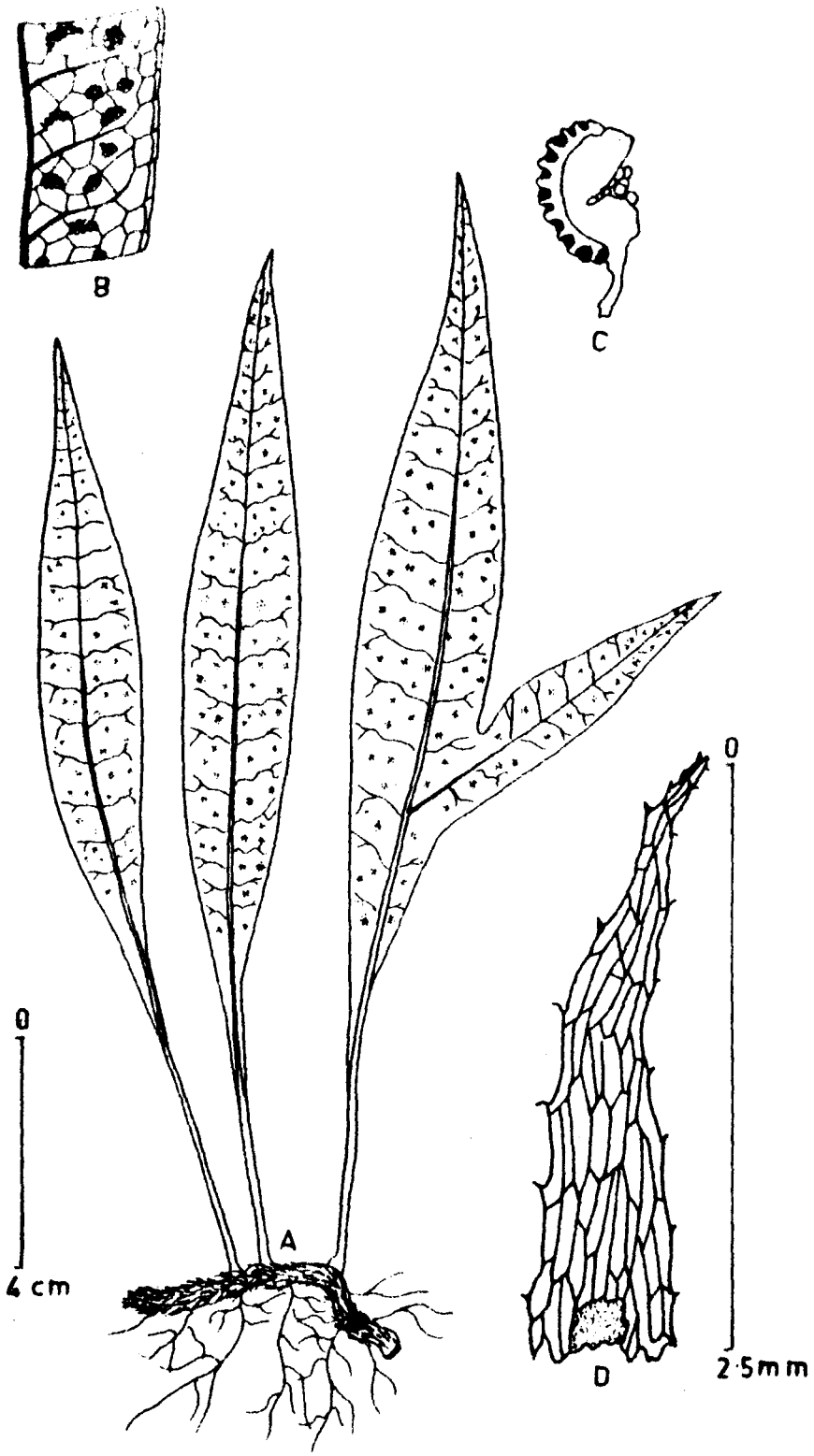


Plate 44: Kaulinia pteropus (Blume) Nayar A - Habit;
B - a portion of fertile frond showing venation;
C - sporangium; D - rhizome scale.

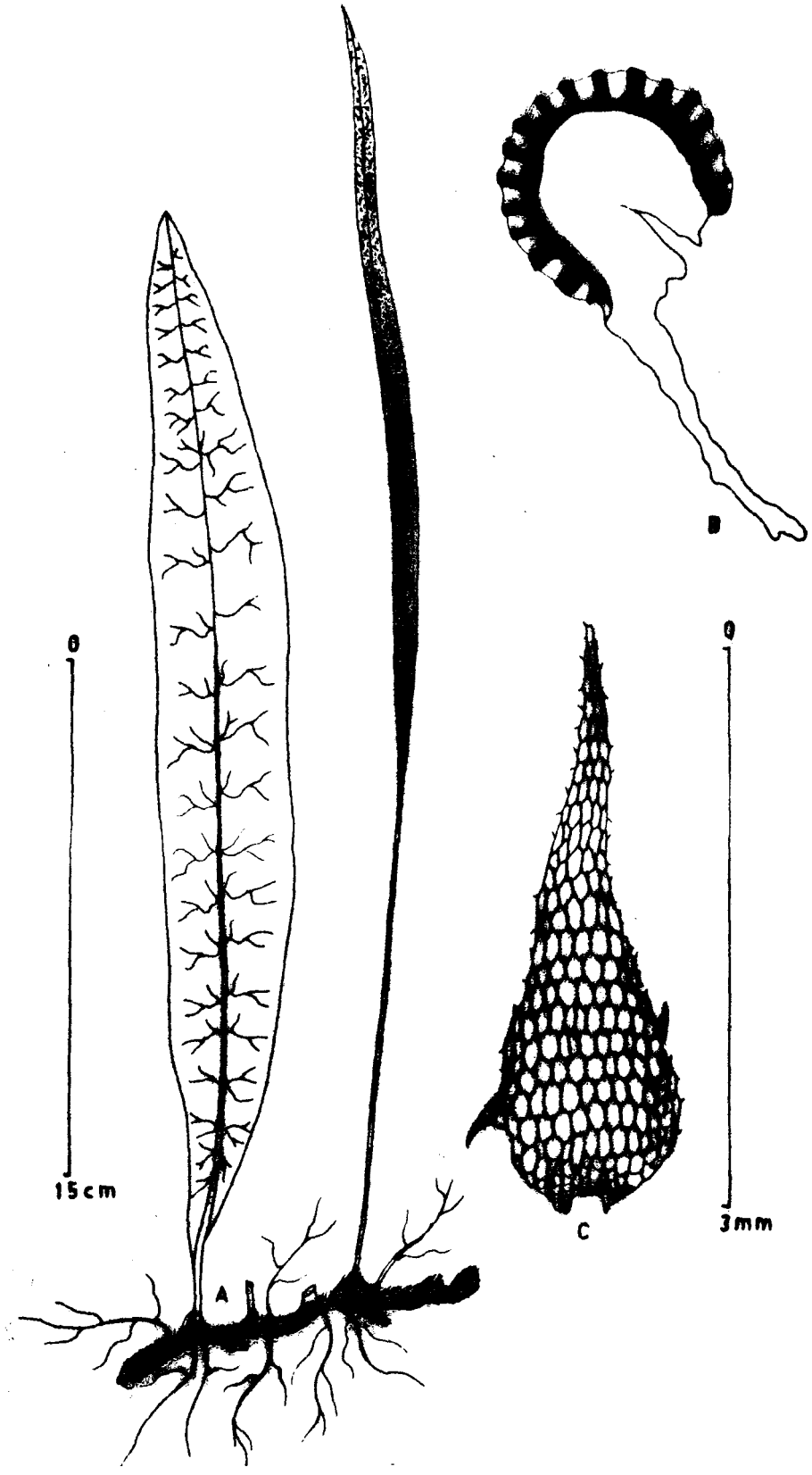


Plate 45: Parolantochilus degwerana (Blume) Copel. A - Habit
B - sporangium; C - rhizome scale.

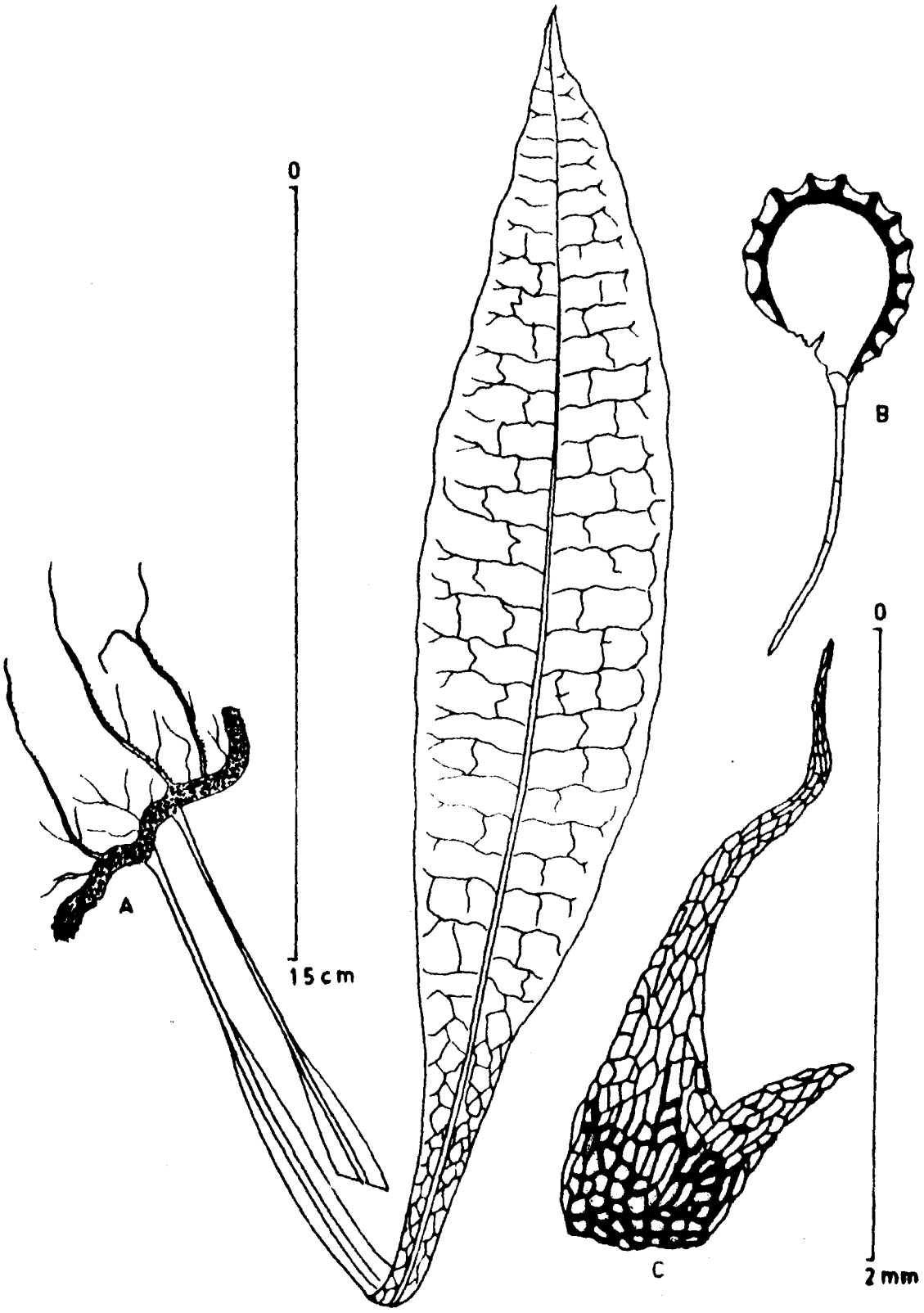


Plate 46: Colysis hemionitidea)Presl.) Presl. A - Habit; B - sporangium; C - rhizome scale.

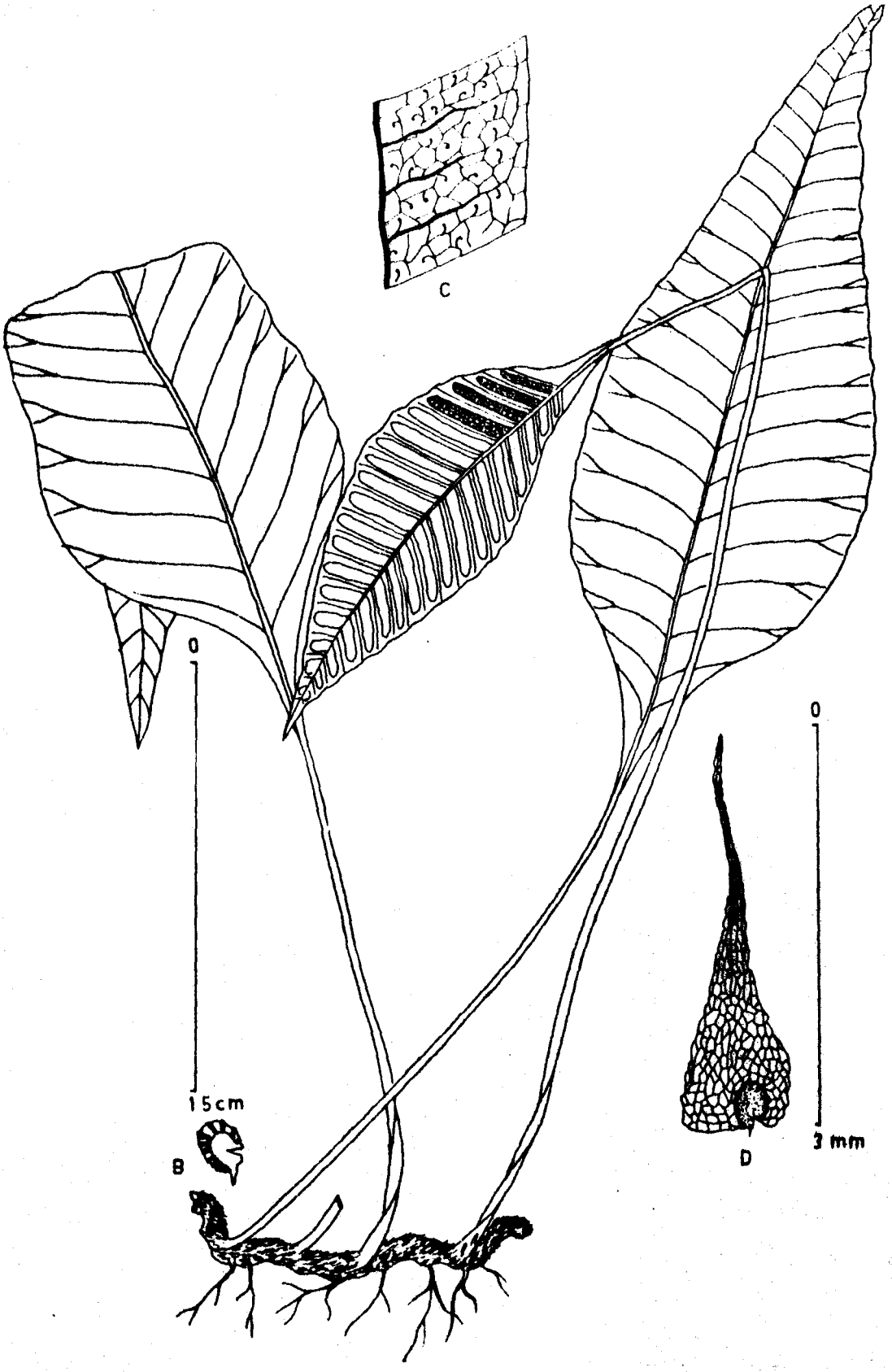


Plate 47: Colysis pedunculata (Hook. et Grev.) Ching
A - Habit; B - sporangium; C - a portion of sterile frond; D - rhizome scale.

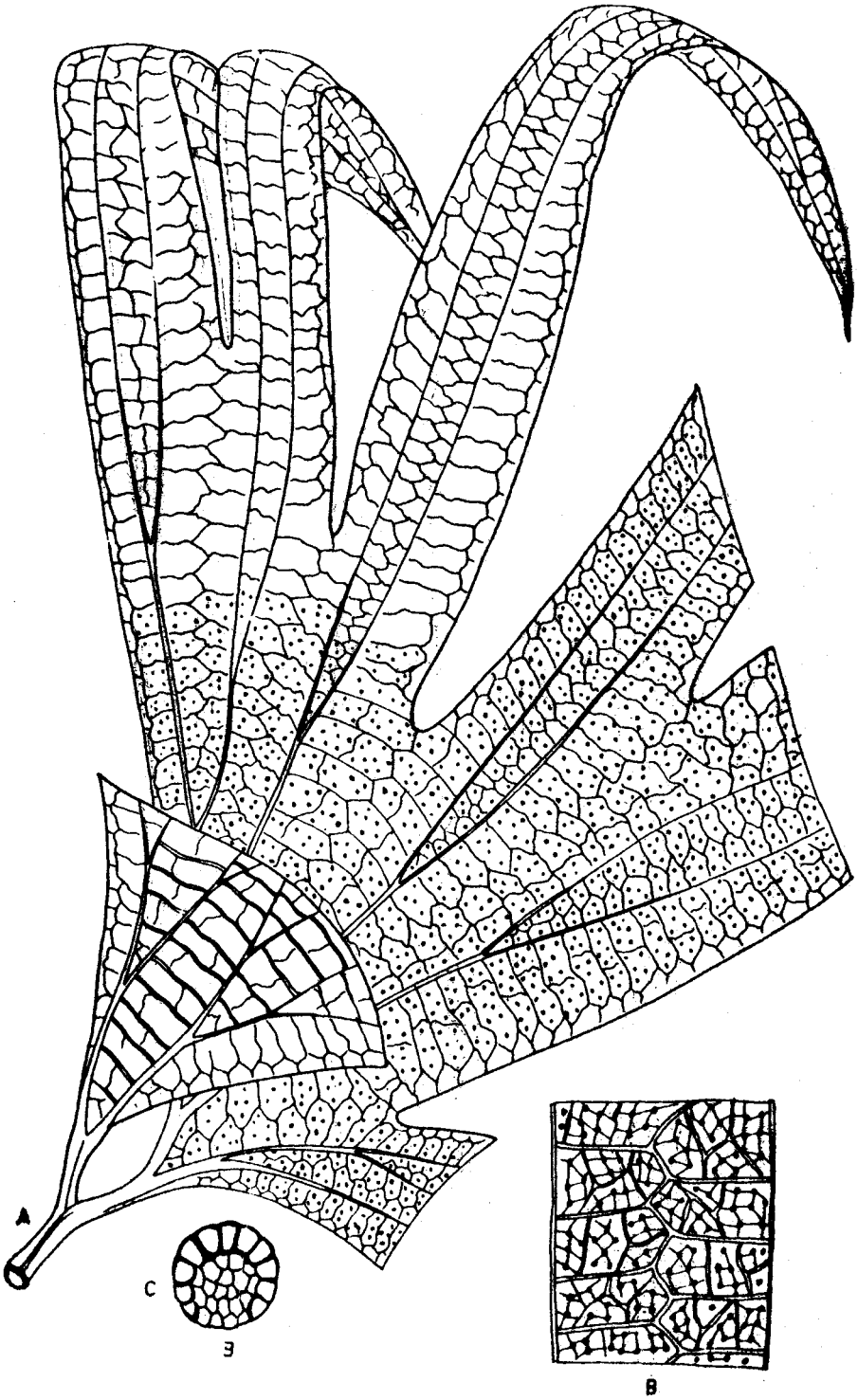


Plate 48: Dipteris wallichii (R.Br.) Moore A - Habit;
B - a portion of frond enlarged; C - sporangium.

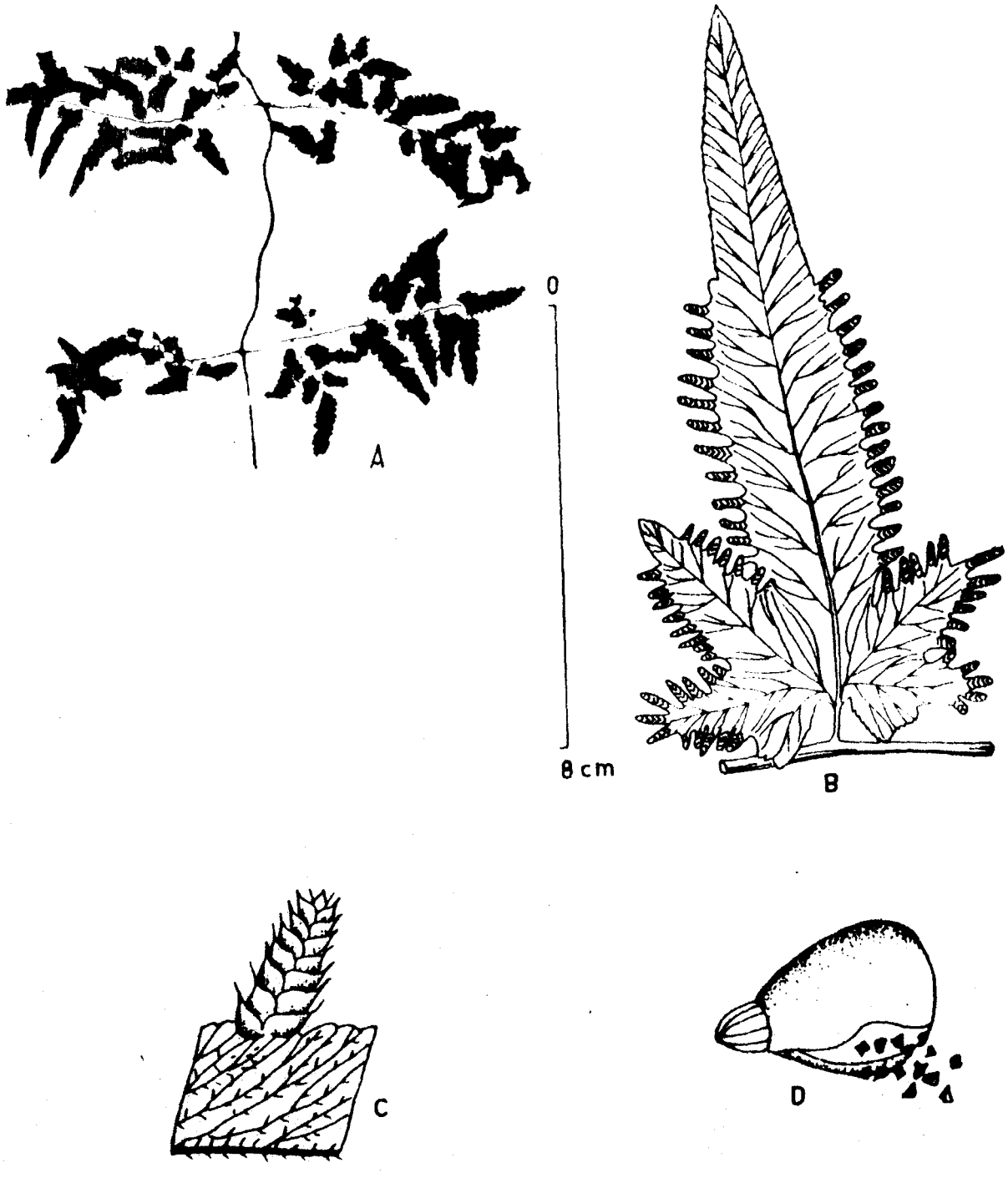


Plate49: Lygodium flexuosum (Linn.) Sw. A- aportion of frond; B- fertile pinna; C- arrangement of sorus on veins.

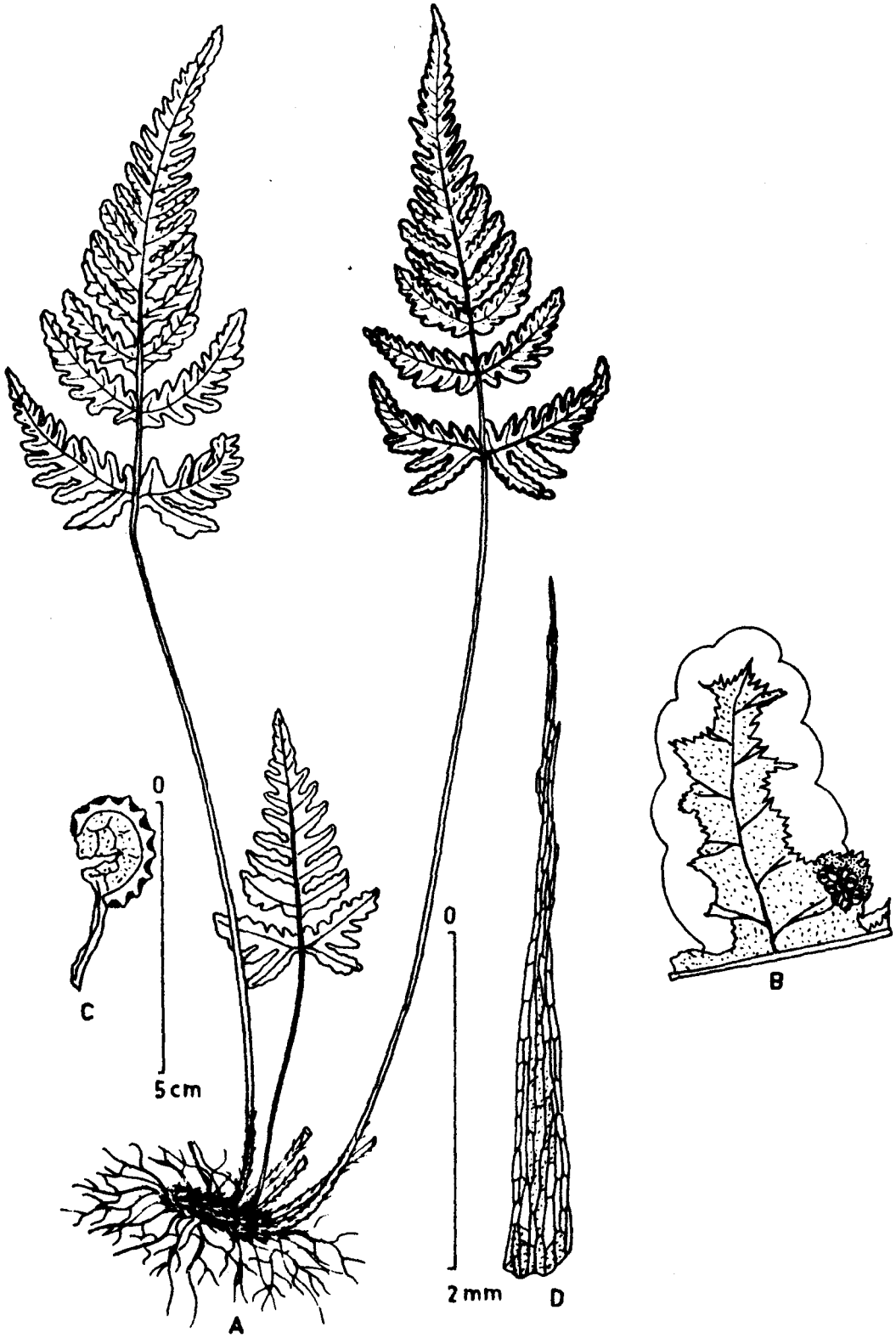


Plate 51: Cheilanthes farinosa (Forsk.) Kaulf. A - Habit; B - fertile pinnule; C - sprangium; D- rhizome scale.

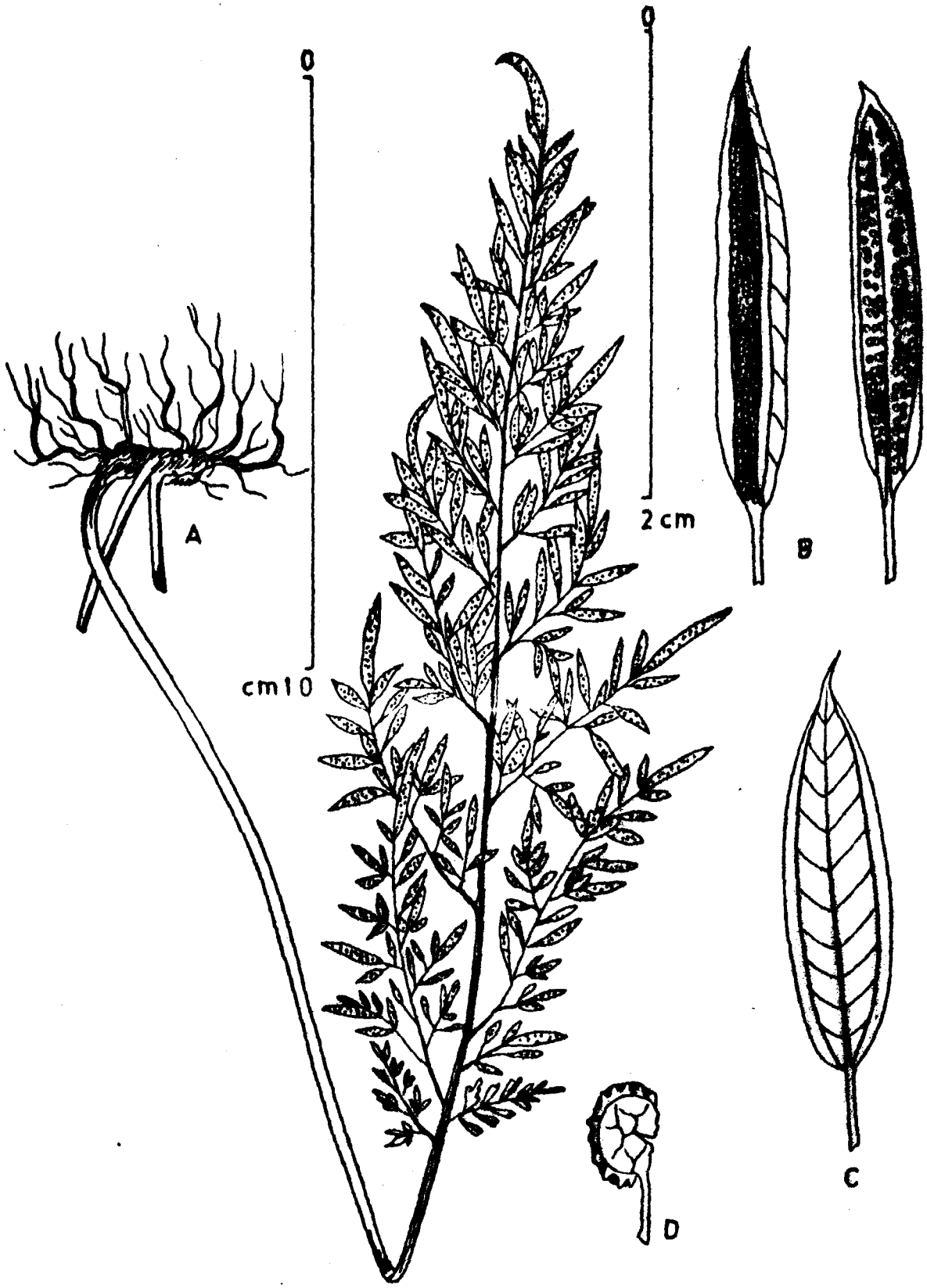


Plate 52: Onychium siliculosum (Desv.) C.Chr. A - Habit; B - fertile pinna; C - dorsal side of pinna with venation; D - sporangium.

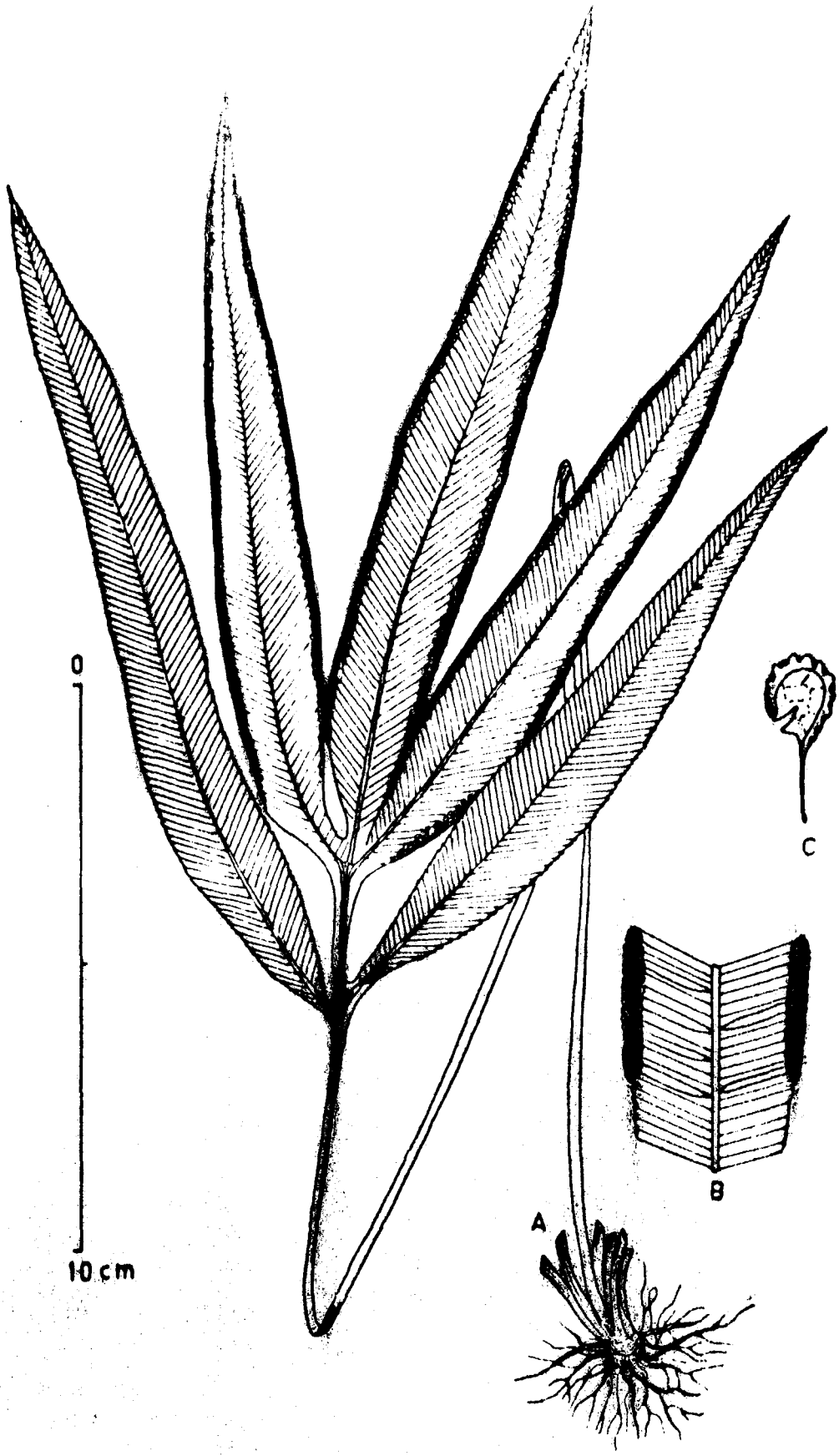


Plate 55: Pteris pellucida Presl. A - Habit; B - a portion of pinna enlarged; C - sporangium.

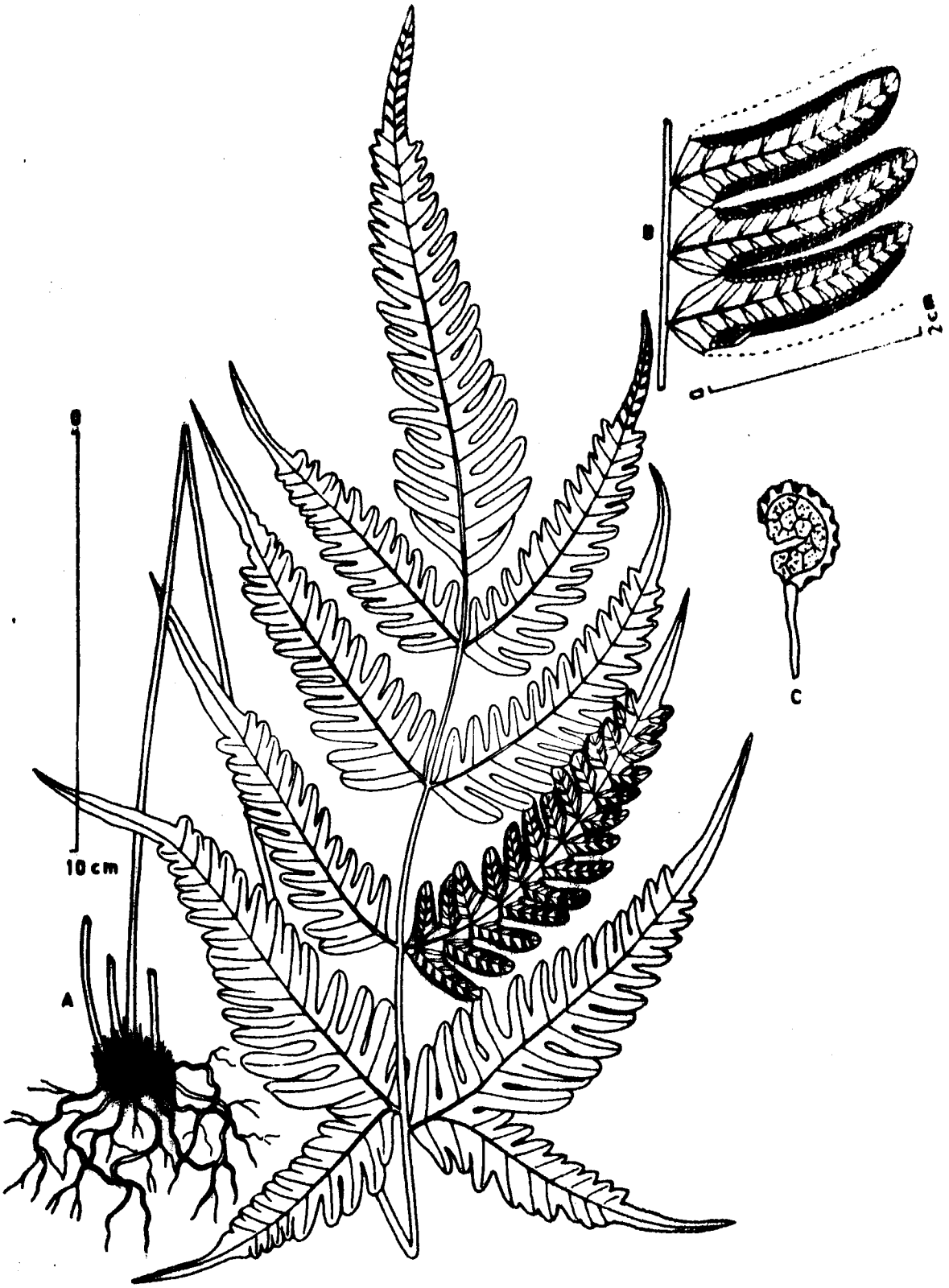


Plate 56: Pteris quadriaurita Retz. A - Habit; B - fertile pinnule; C - sporangium.

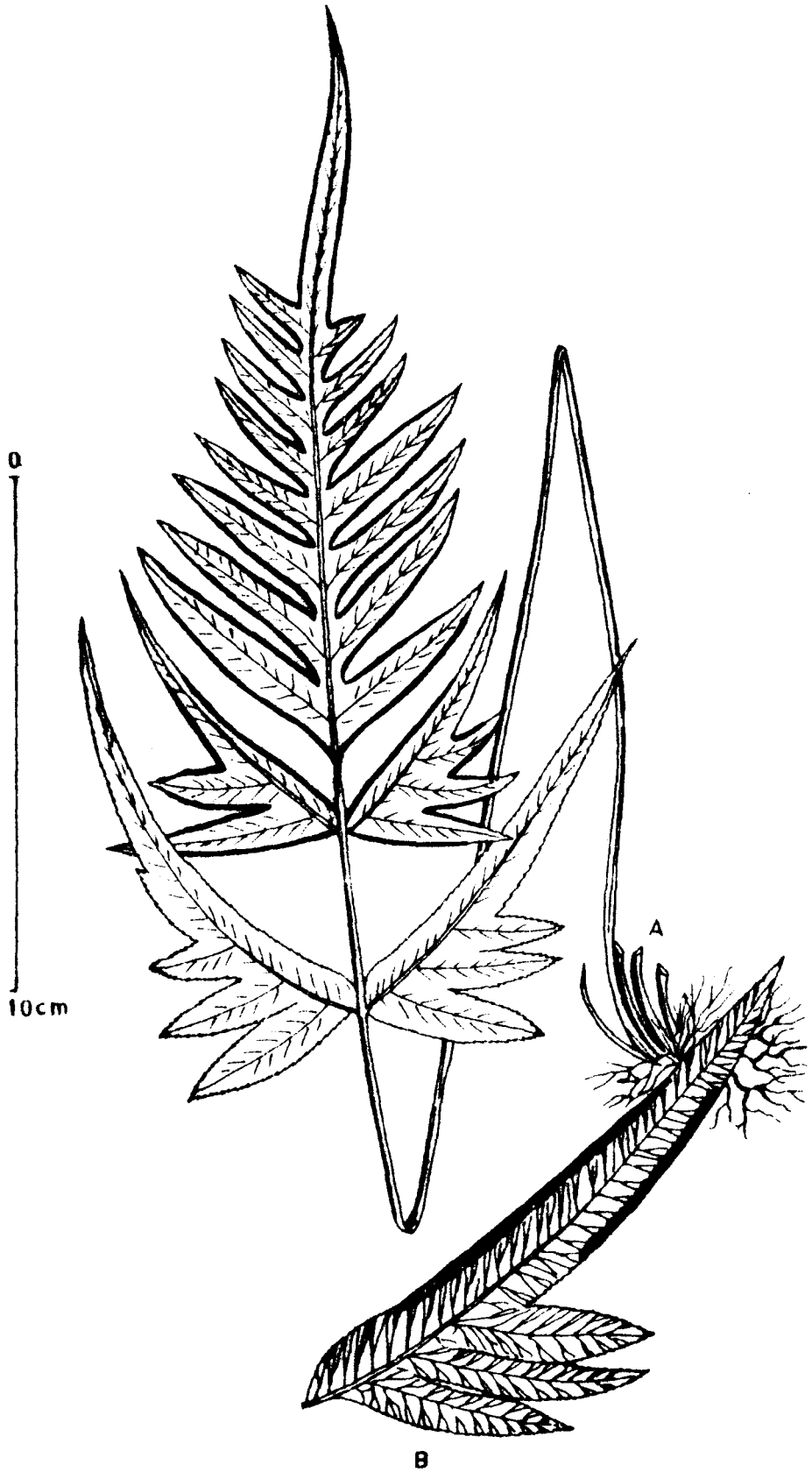


Plate 56A: Pteris semipinnata Linn. A - Habit; B - fertile pinna enlarged.

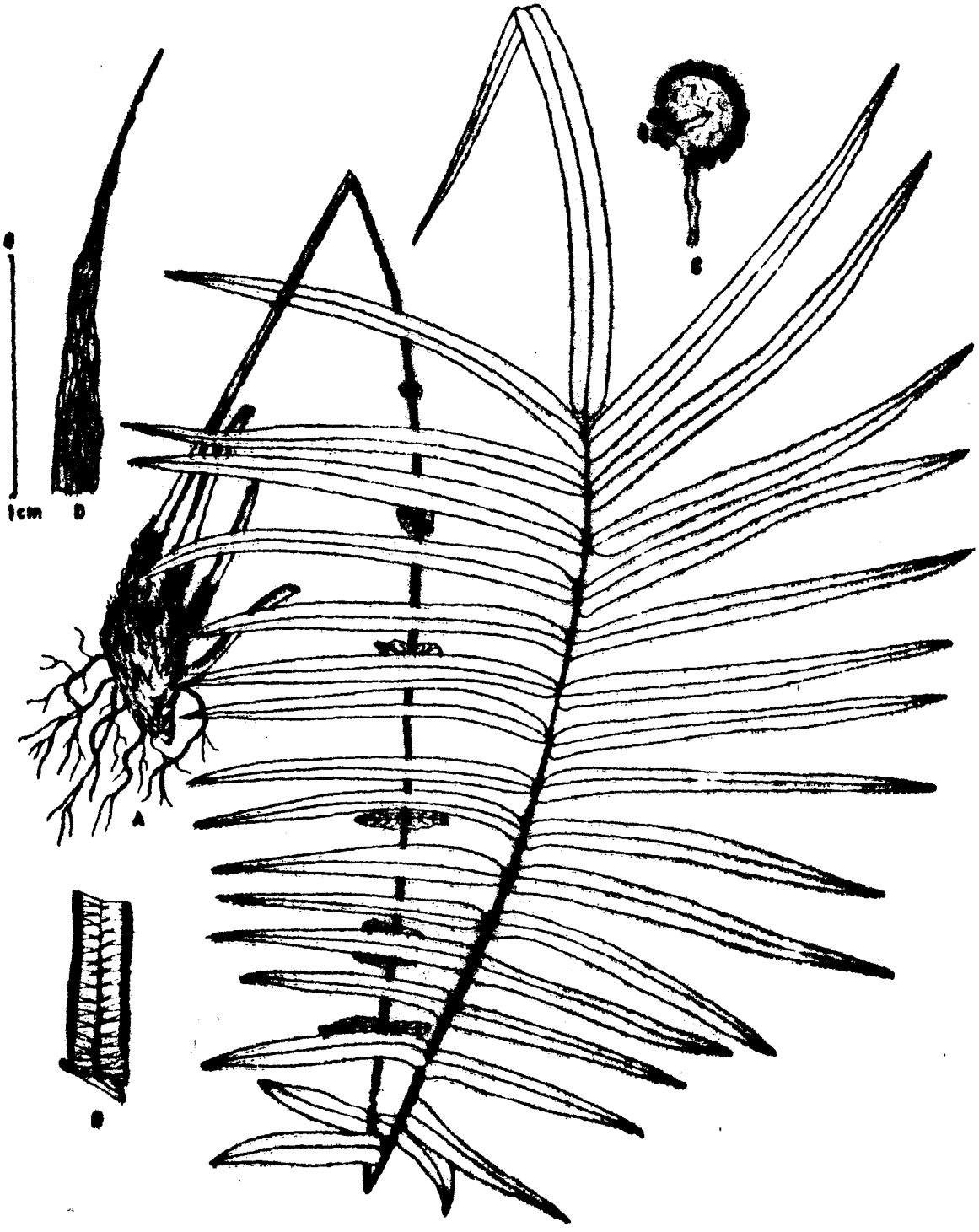


Plate 57: Ehrharta villosa Lam. A - Habit; B - Fertile pinna showing venation; C - sporangium; D - rhizome scale.

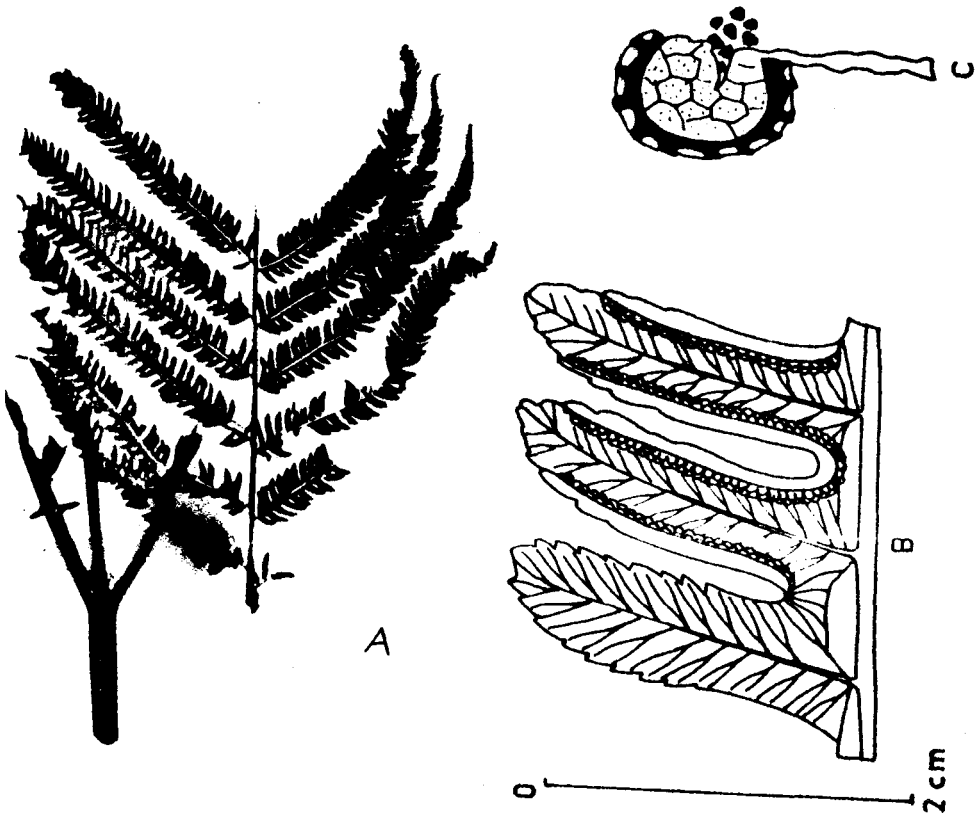


Plate 58: Pteris wallichiana Ag. A - Habit; B - pinnule with sori and venation; C - sporangium.

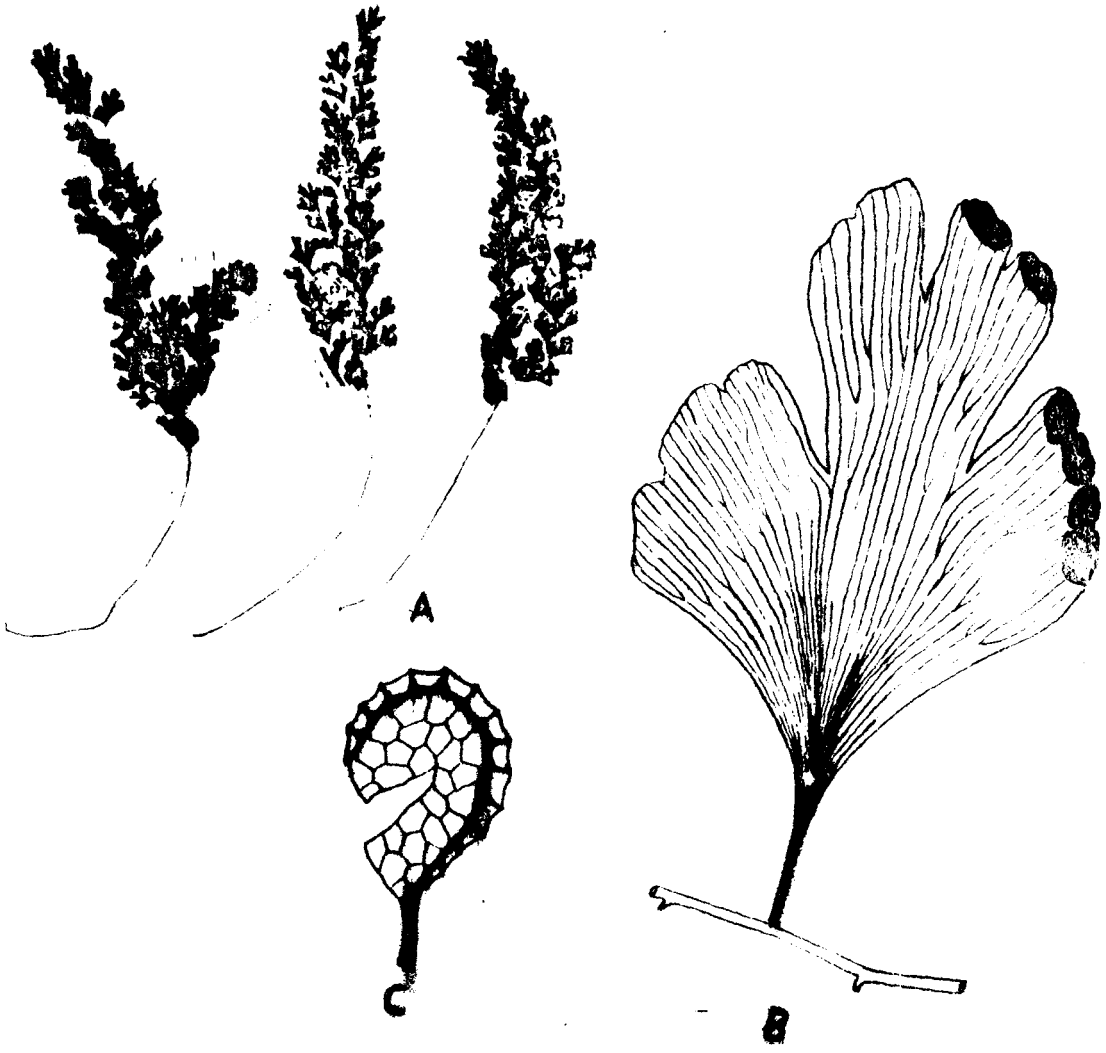


Plate 58A : Adiantum capillusveneris Linn. A - Habit; B - a pinna; C - sporangium.

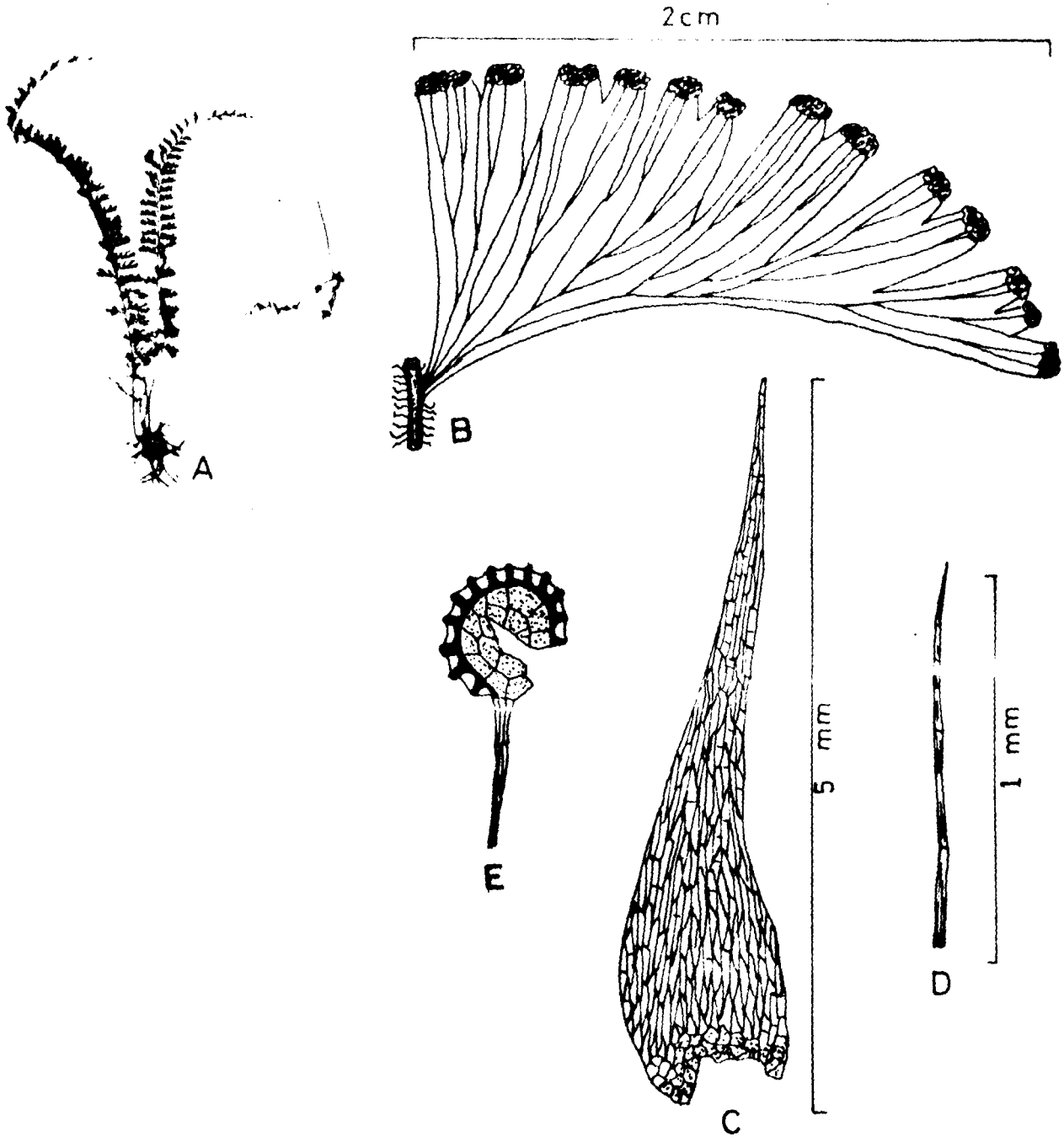


Plate 59: <u>Adiantum caudatum</u> Linn. A - Habit; B - pinna showing venation and sori; C- rhizome scale; D - stipe scale; E - sporangium.

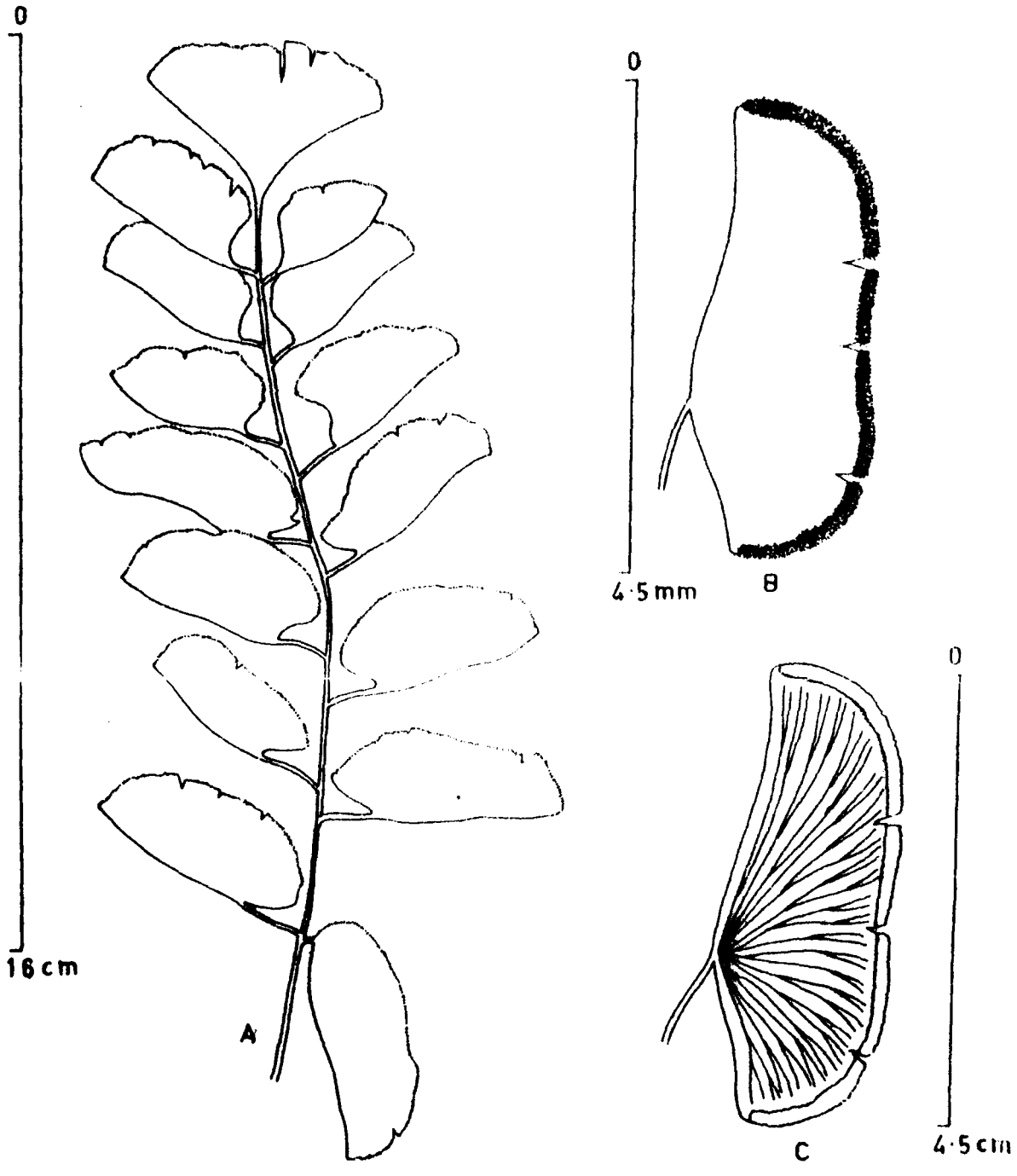


Plate 60: Adiantum philippense Linn. A - Habit; B - pinna with sori; C - pinna showing venation.

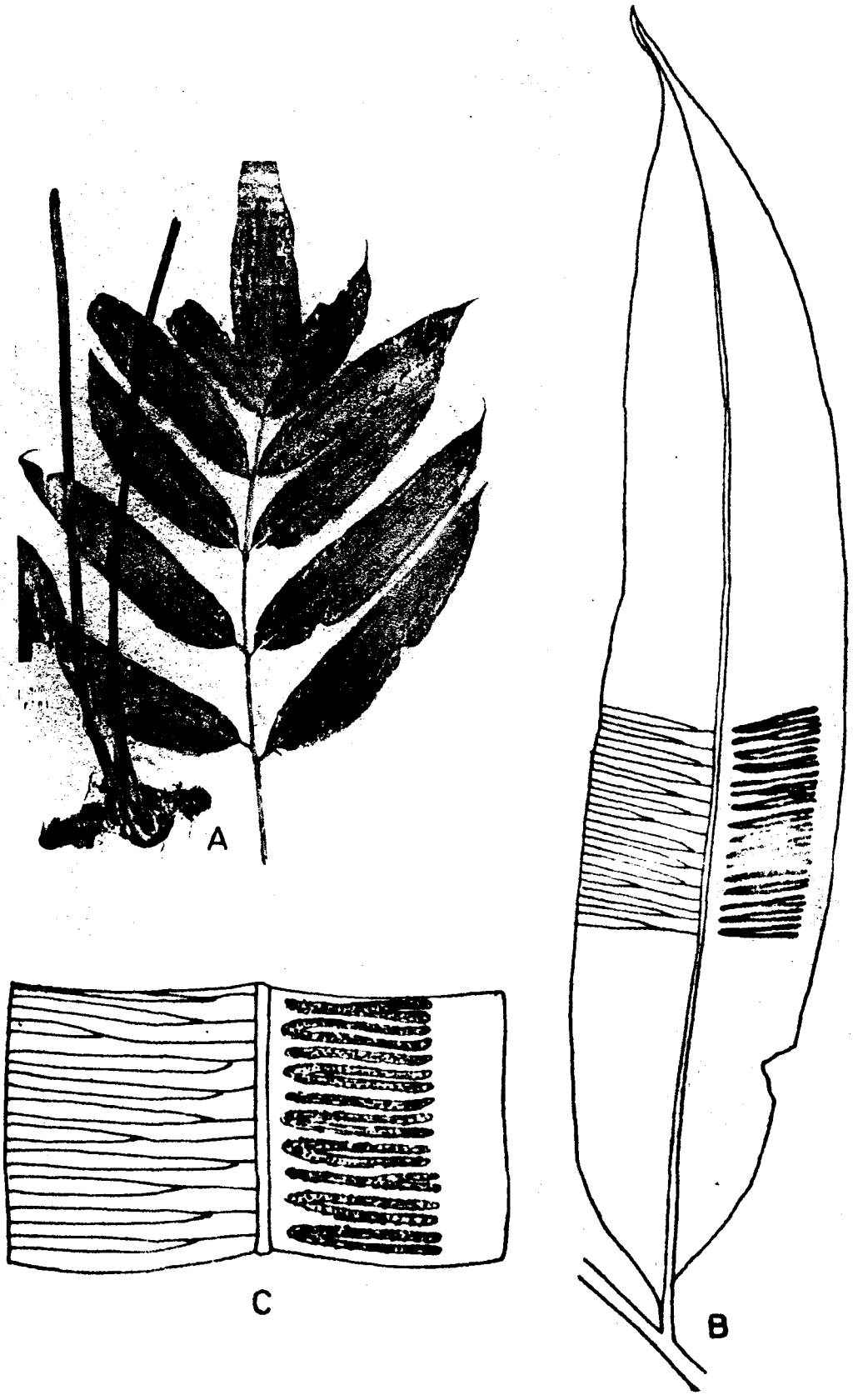


Plate 61: Coniogramme fraxinea (D. Don) Diels A - Habit; B - fertile pinna; C - a portion of pinna enlarged showing venation and sori.

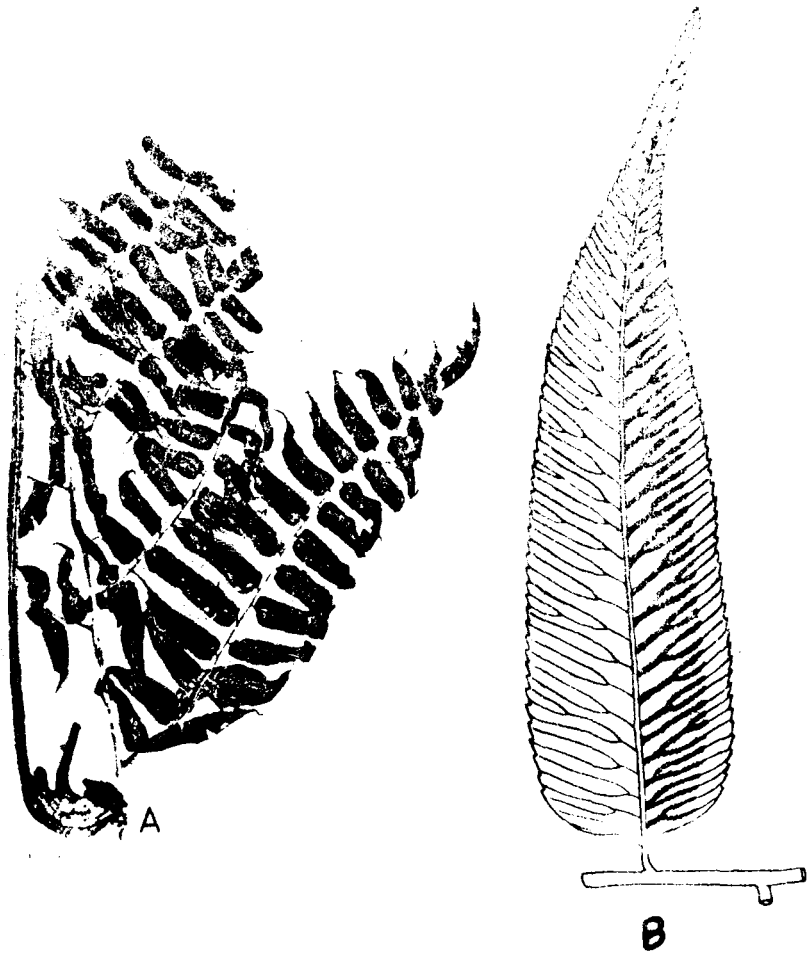


Plate 62: Coniogramme procera Wall. ex Fee. A - Habit;
B - pinna showing venation and sori.

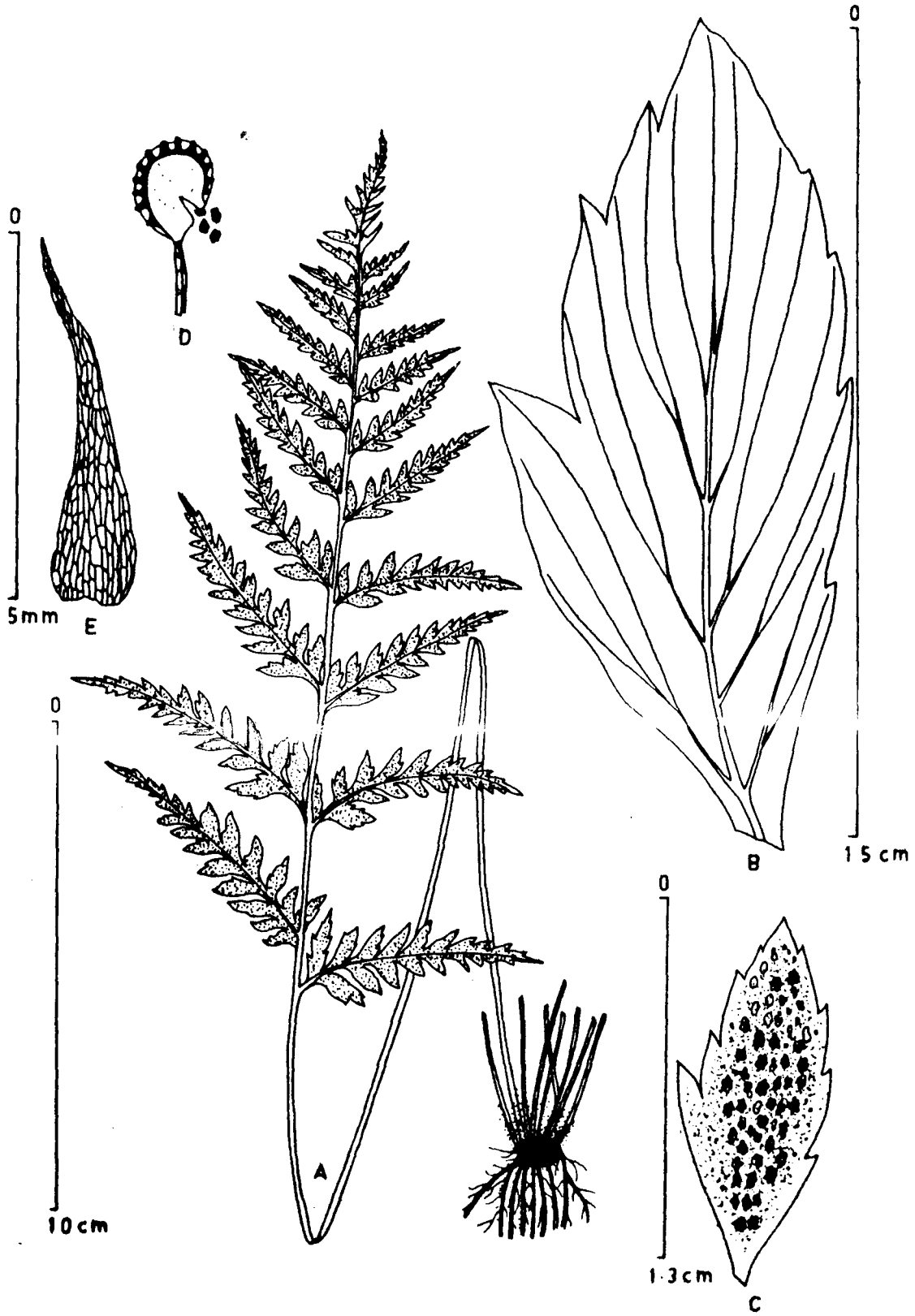


Plate 63: Pityrogramma calomelanos (Linn.) Link. A - Habit; B - a pinnule; C - pinnule with sori; D - sporangium.

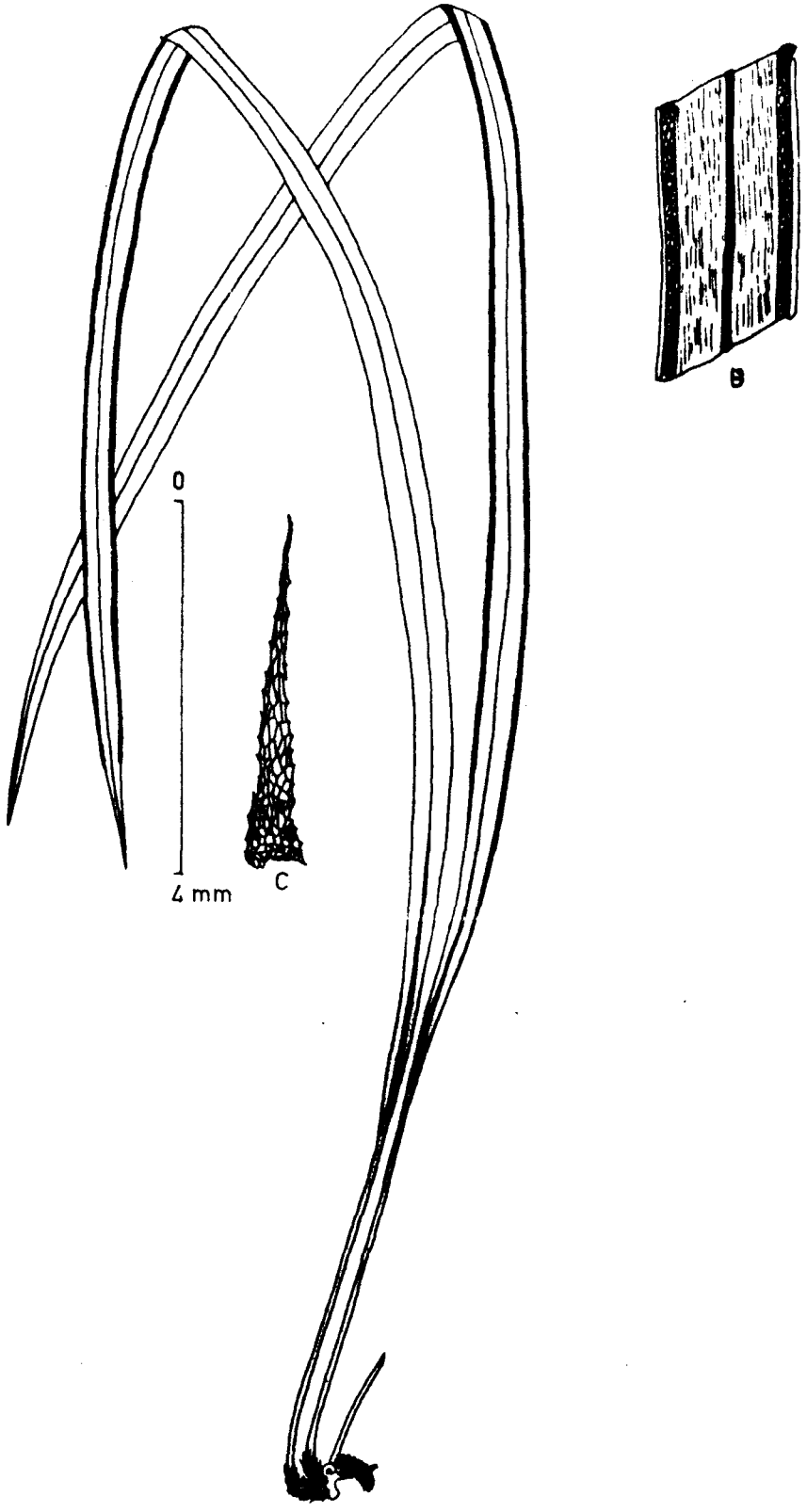


Plate 64: Vittaria elongata Sw. A - Habit; B - a portion of fertile frond enlarged; C - rhizome scale.

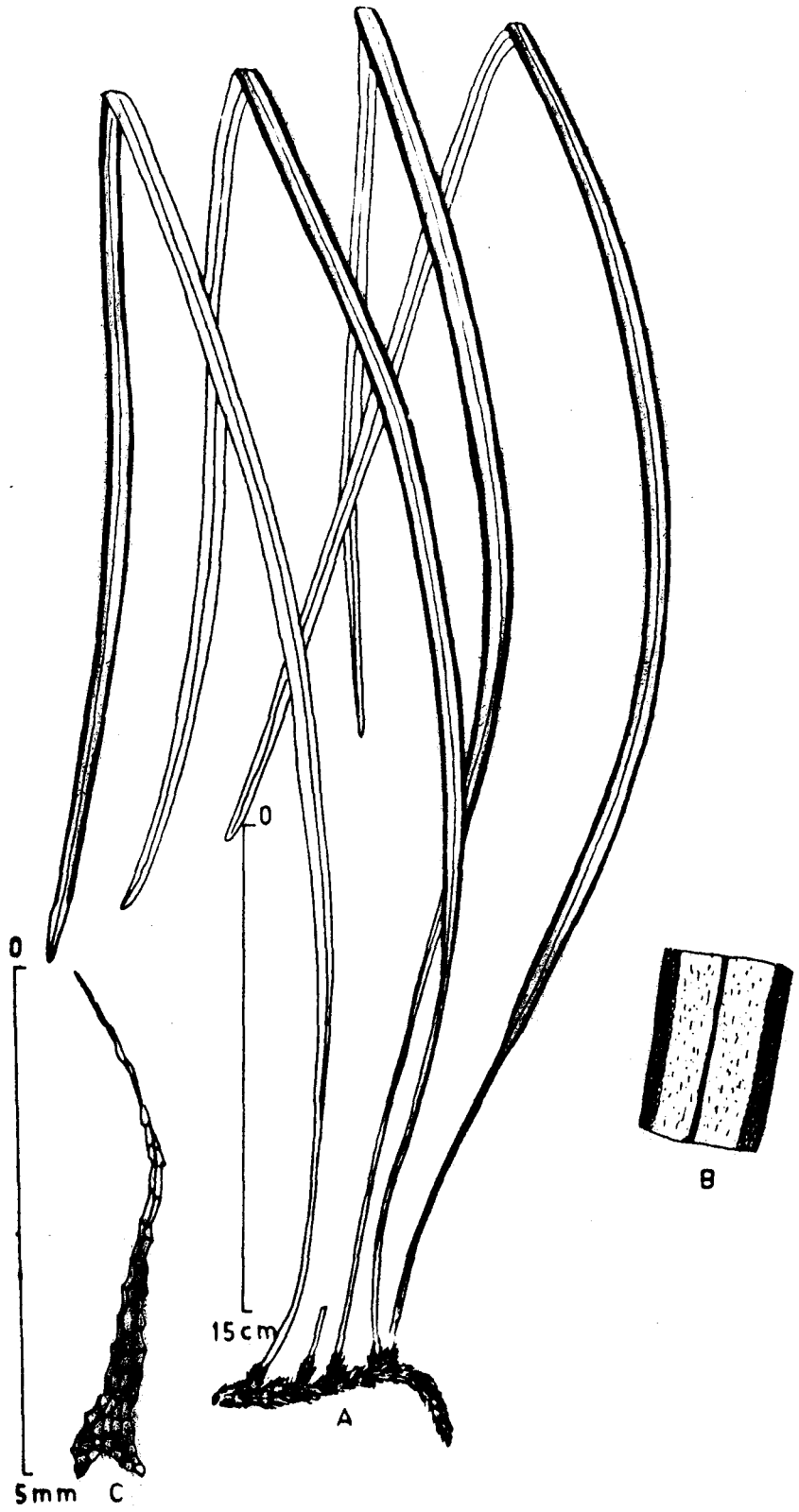


Plate 65: Vittaria zosterifolia Willd. A - Habit; - a portion of fertile frond; C - rhizome scale.

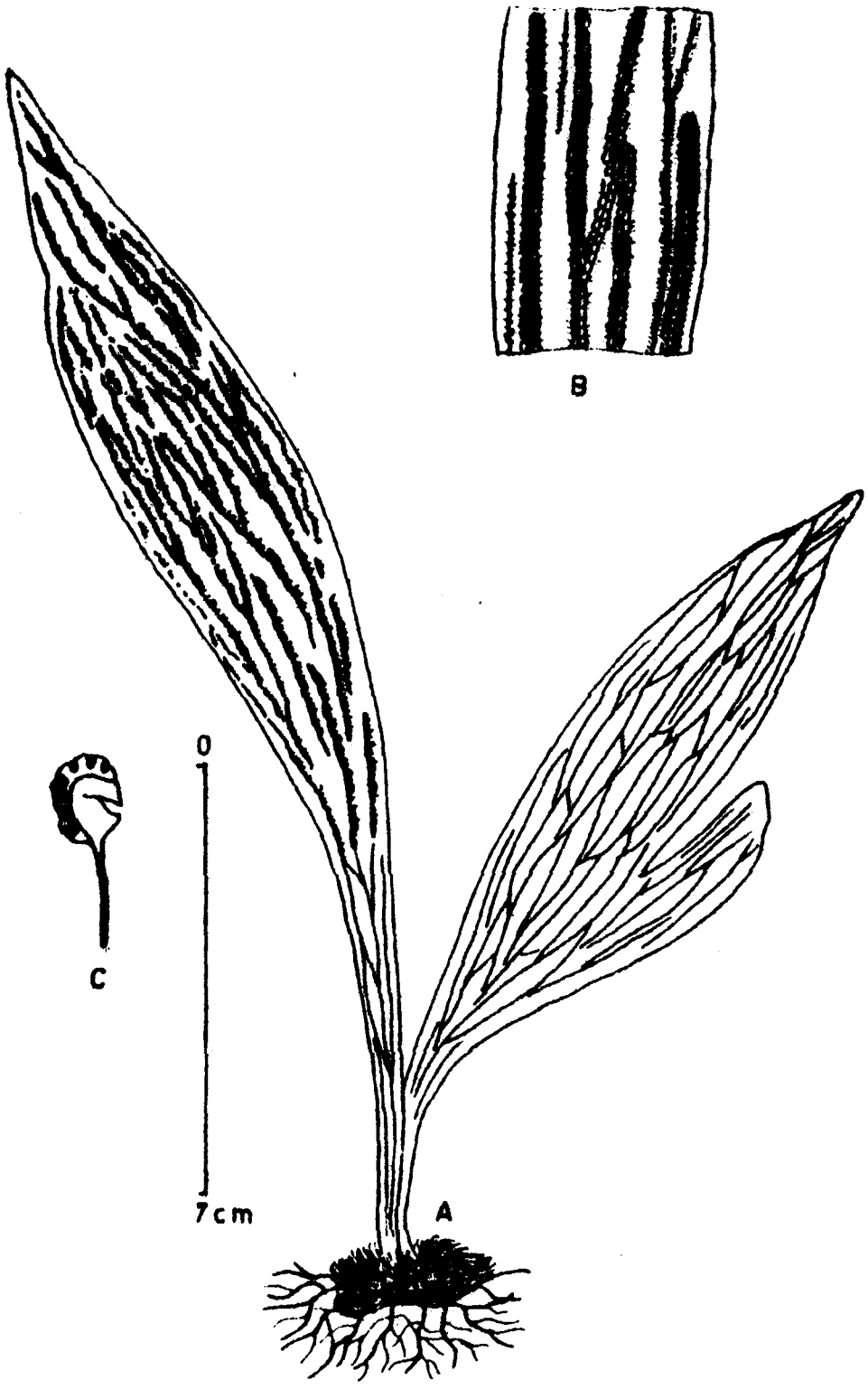


Plate 66: Anthrophyum plantagineum (Cav.) Kauf. A - Habit;
B - a portion of frond showing venation nad sori;
C - sporangium.

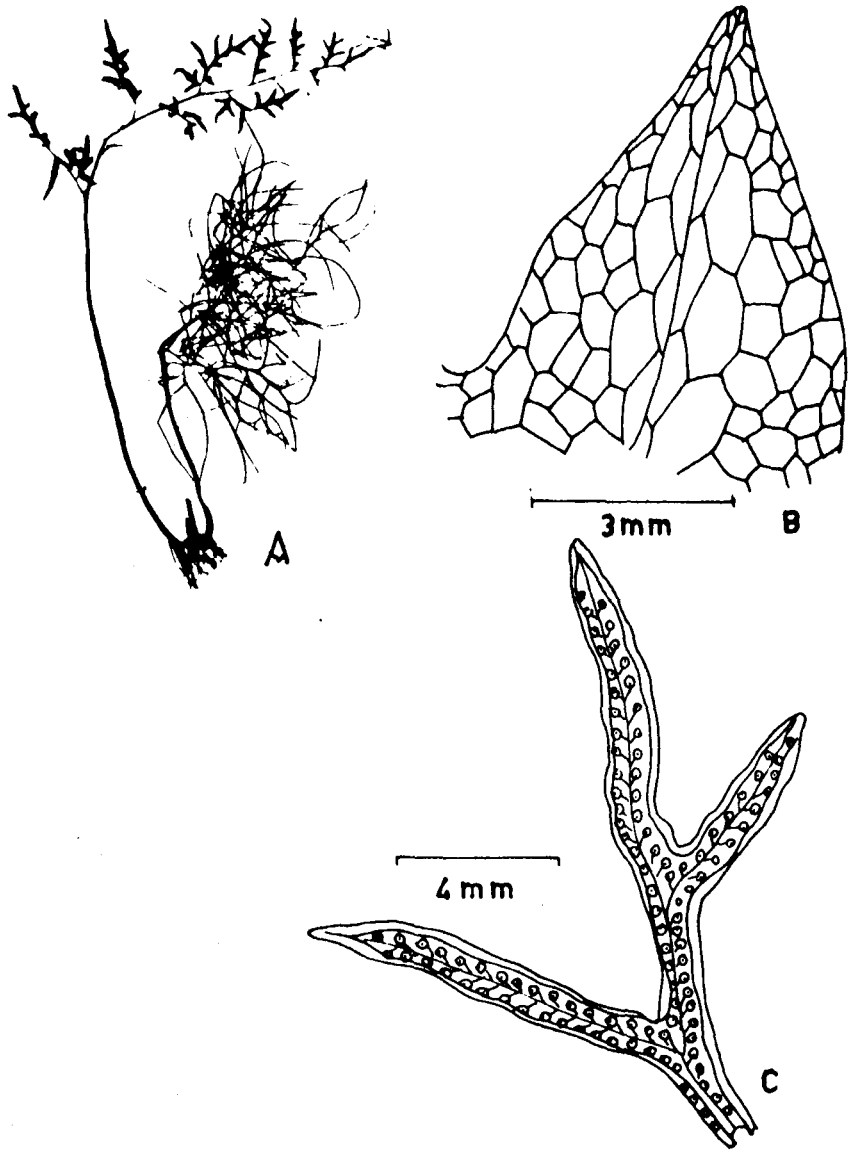


Plate 67: Ceraptopteris thallictroides (Linn.) Brong. A - Habit; B - portion of sterile frond; C - portion of fertile frond; D - sporangium; E - spores.

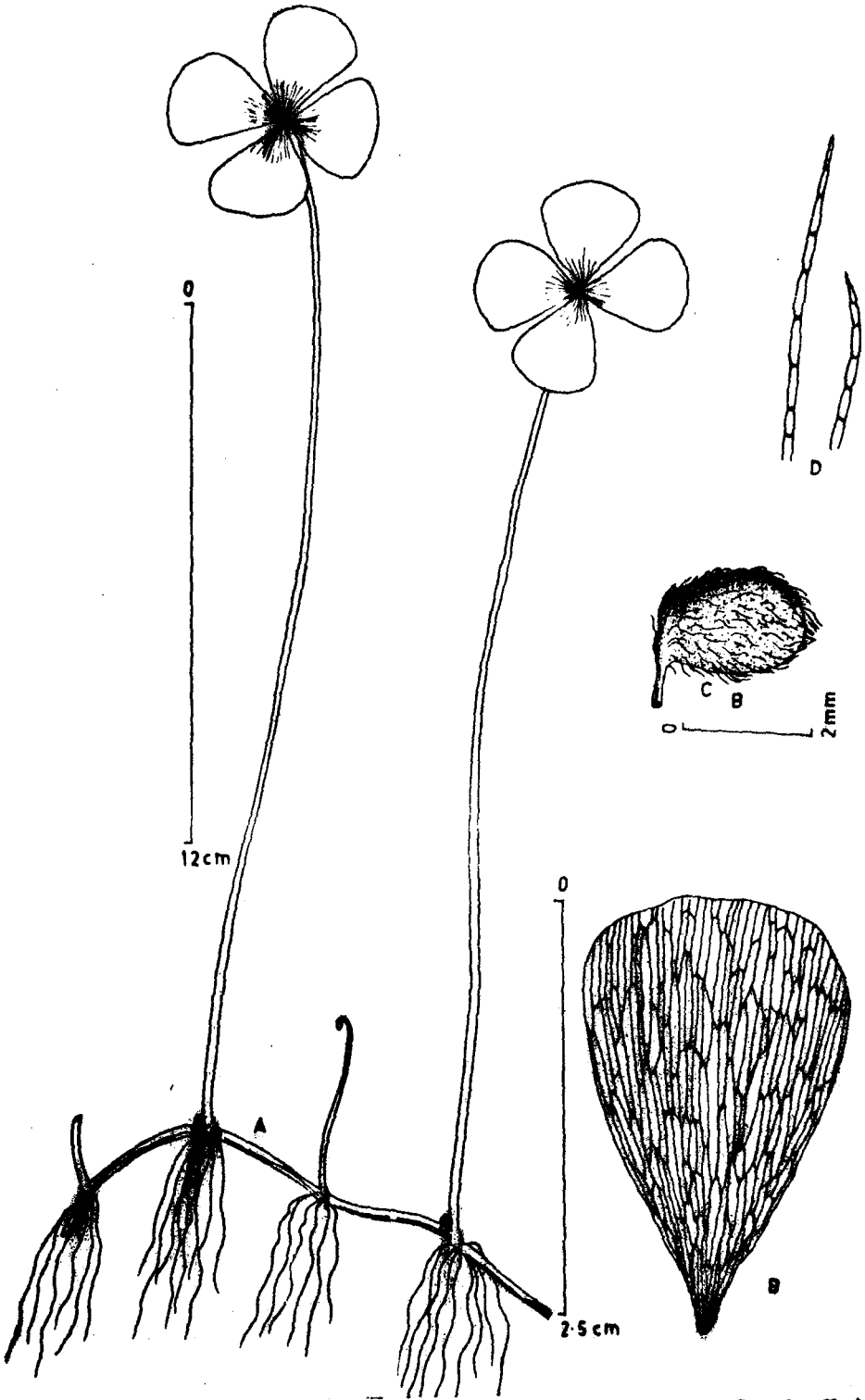


Plate 68: Marsilea quadrifolia Linn. A - Habit; B - leaflet showing venation; C - sporocarp; D - multicellular hairs from sporocarp.

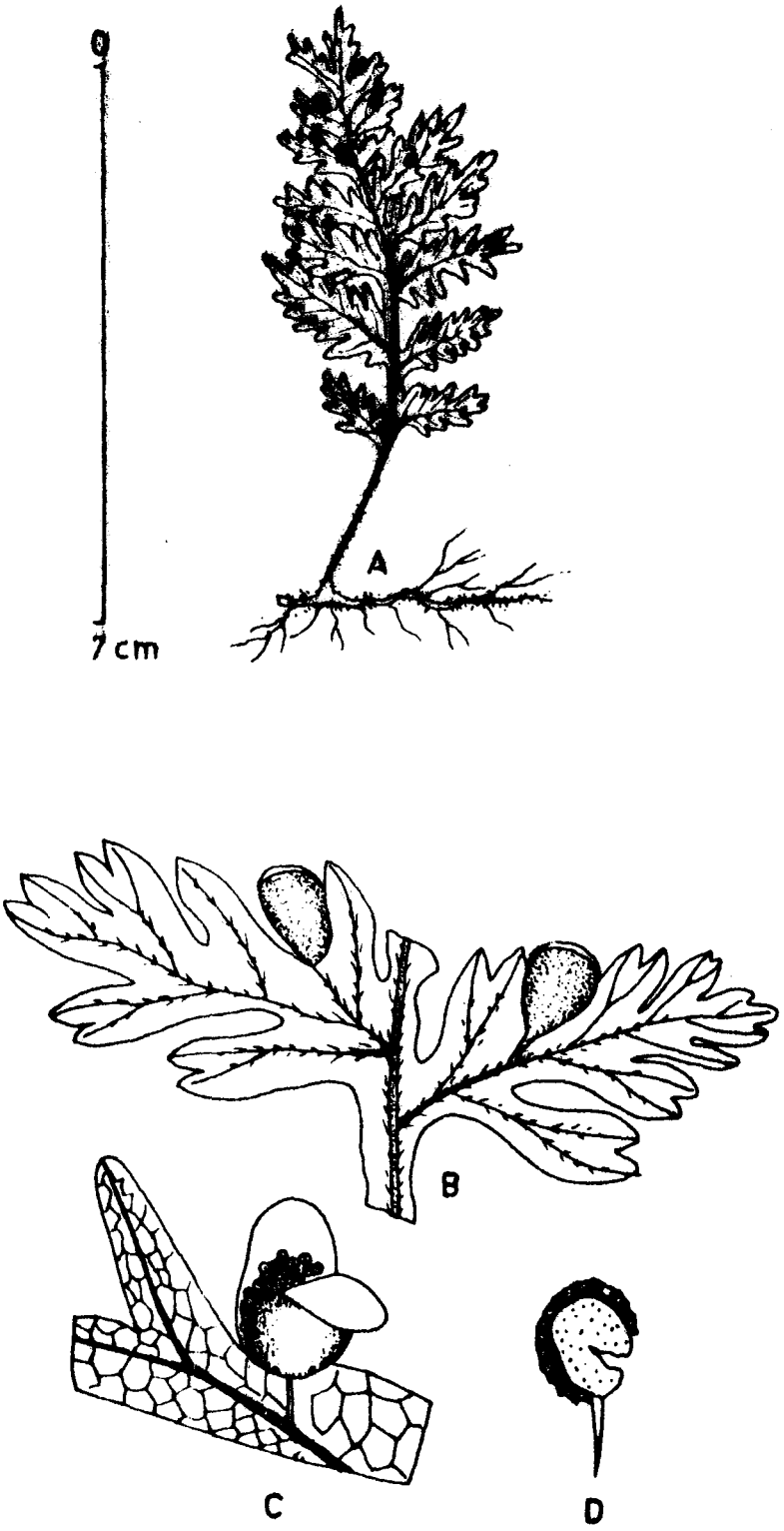


Plate 69: Macodium exsertum (Wall. ex Hook.) Copel. A - Habit; B - pinna showing venation and sori; C - sorus; D - sporangium.

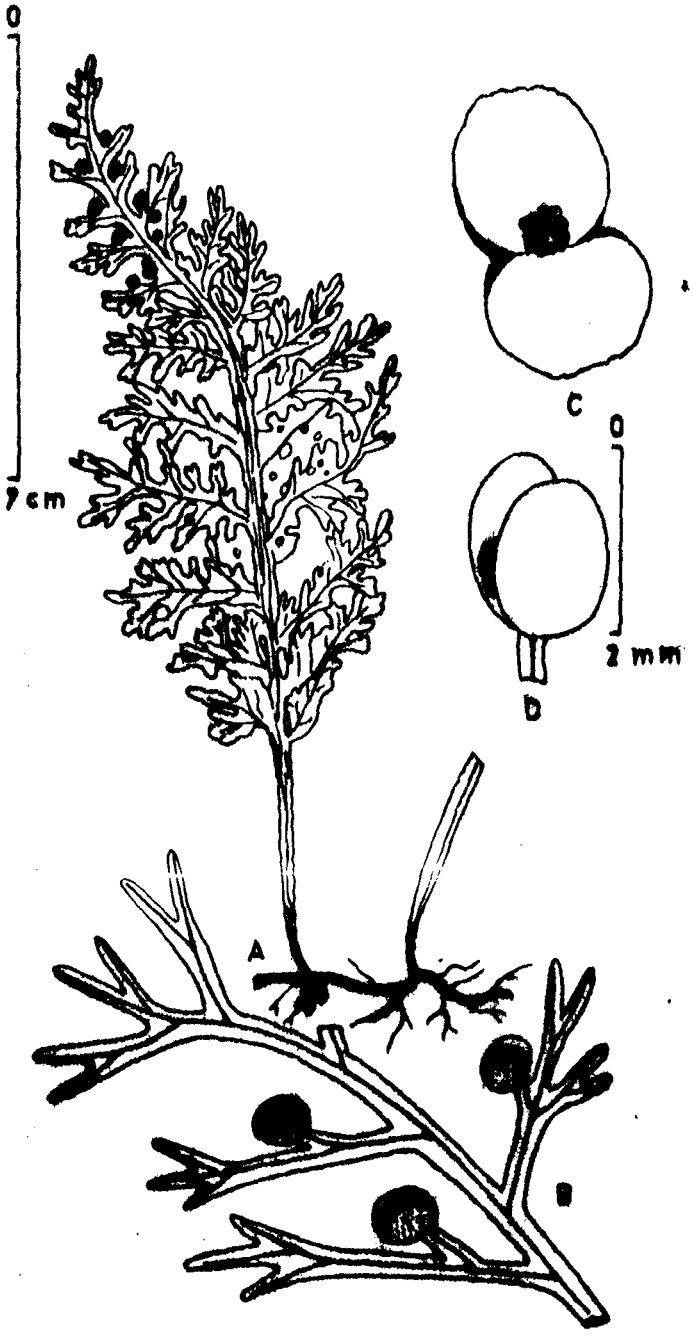


Plate 70: Macodium javanicum (Spring) Copel. A - Habit; B - fertile pinna; C &D - sori.

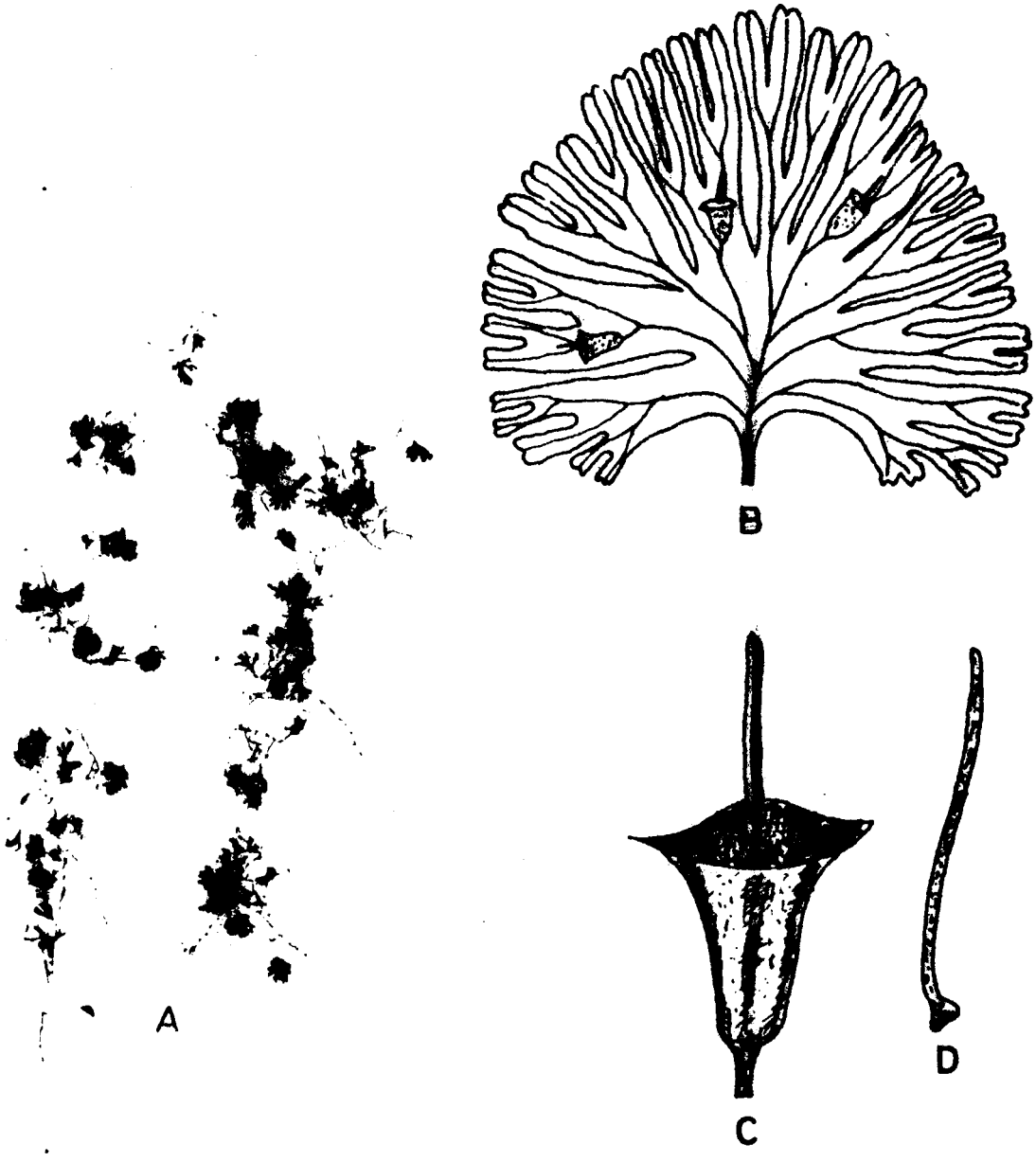


Plate 71: Gonocormus minutus (Blume) V.D.Bosch. A- Habit; B - fertile frond; C - sorus; E - rhizome hair.

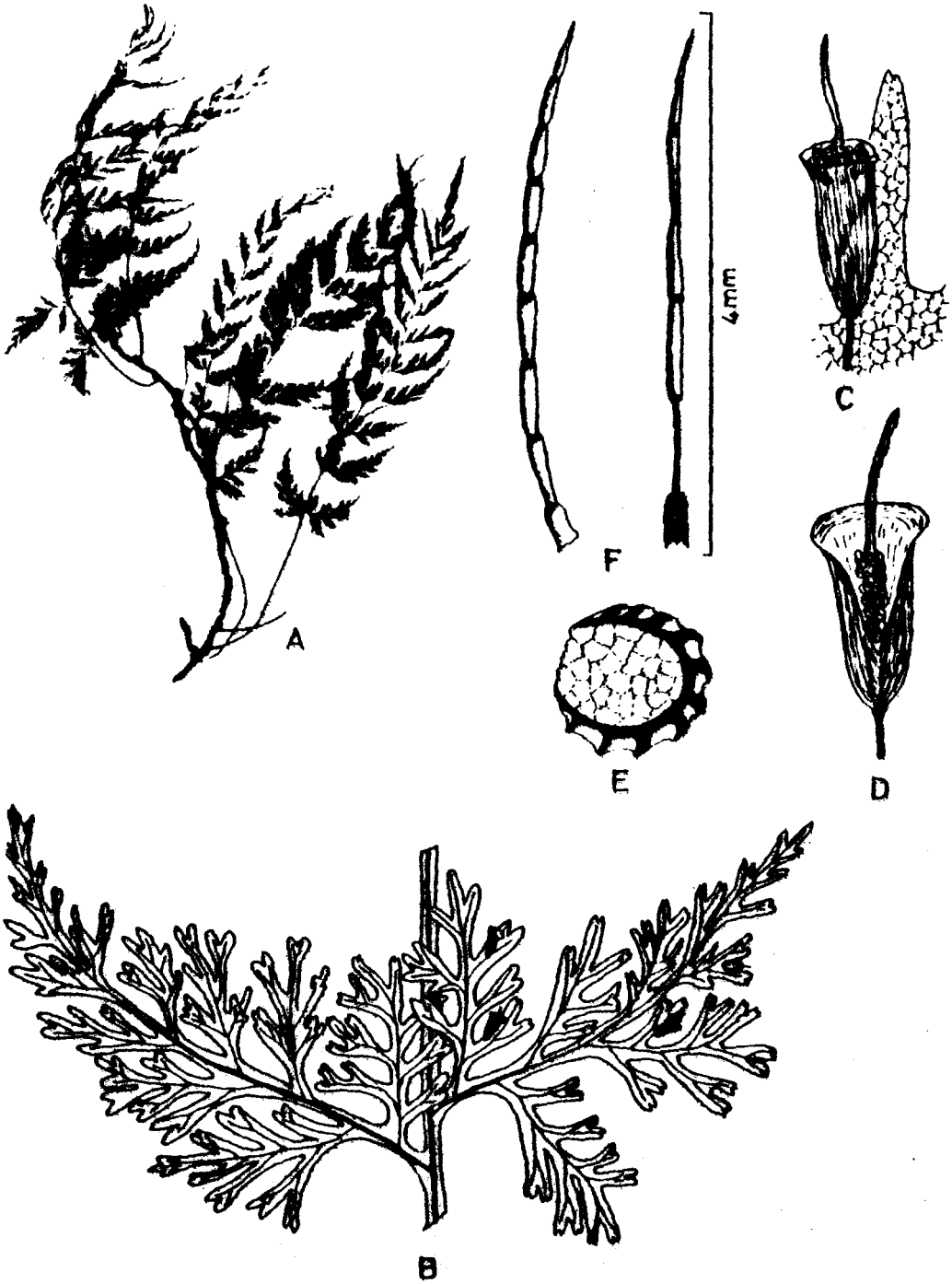


Plate 72: Vandenboschia radicans (Sw.) Copel A - Habit;
B - a portion of frond enlarged; C&D - sori;
E - sprangium; F - rhizome hairs.

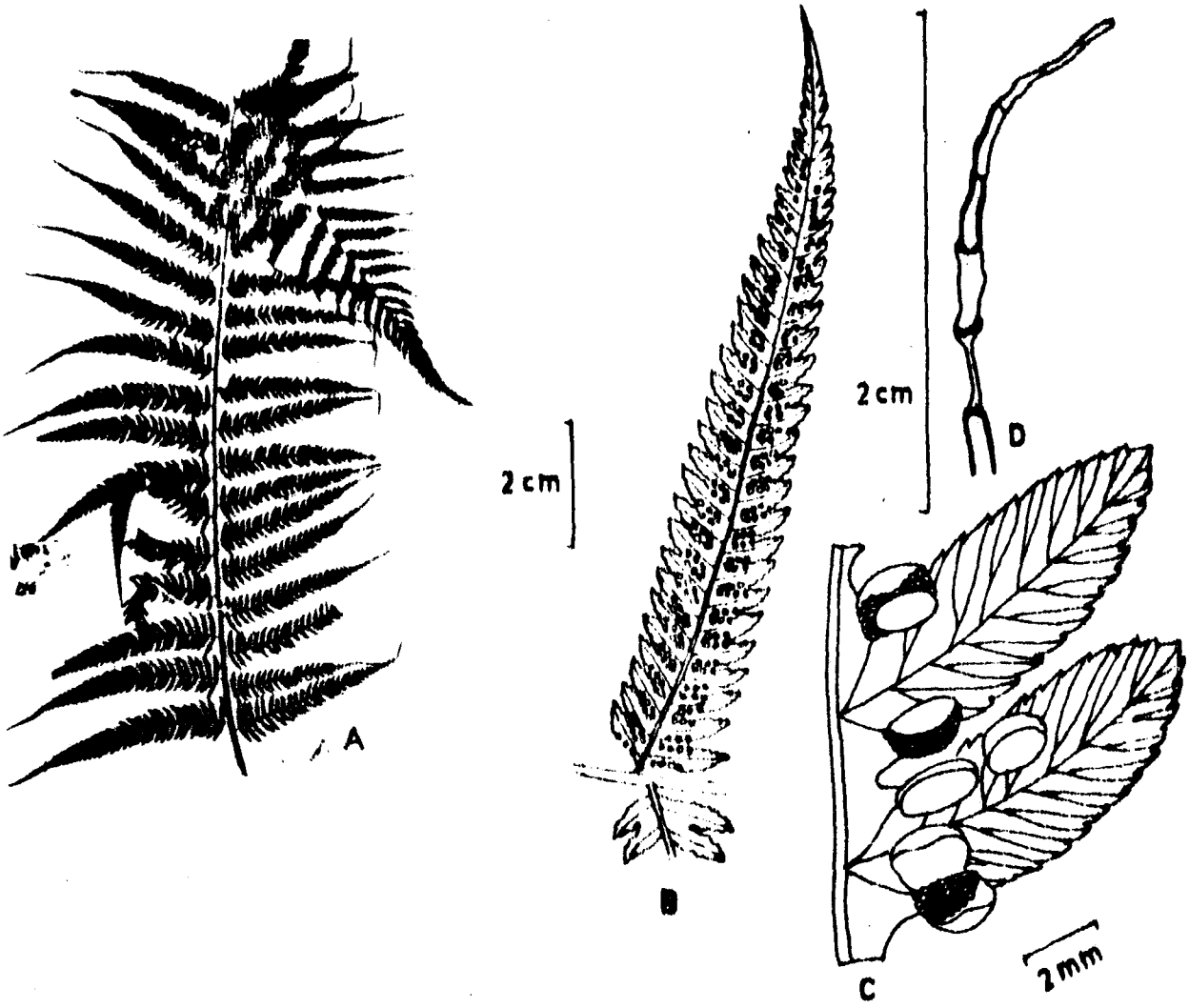


Plate 73: Cibotium barometz (Linn.) J. Smith A - A portion of frond; B - a pinna; C - portion of pinna enlarged showing the arrangement of sori; D - rhizome hair.

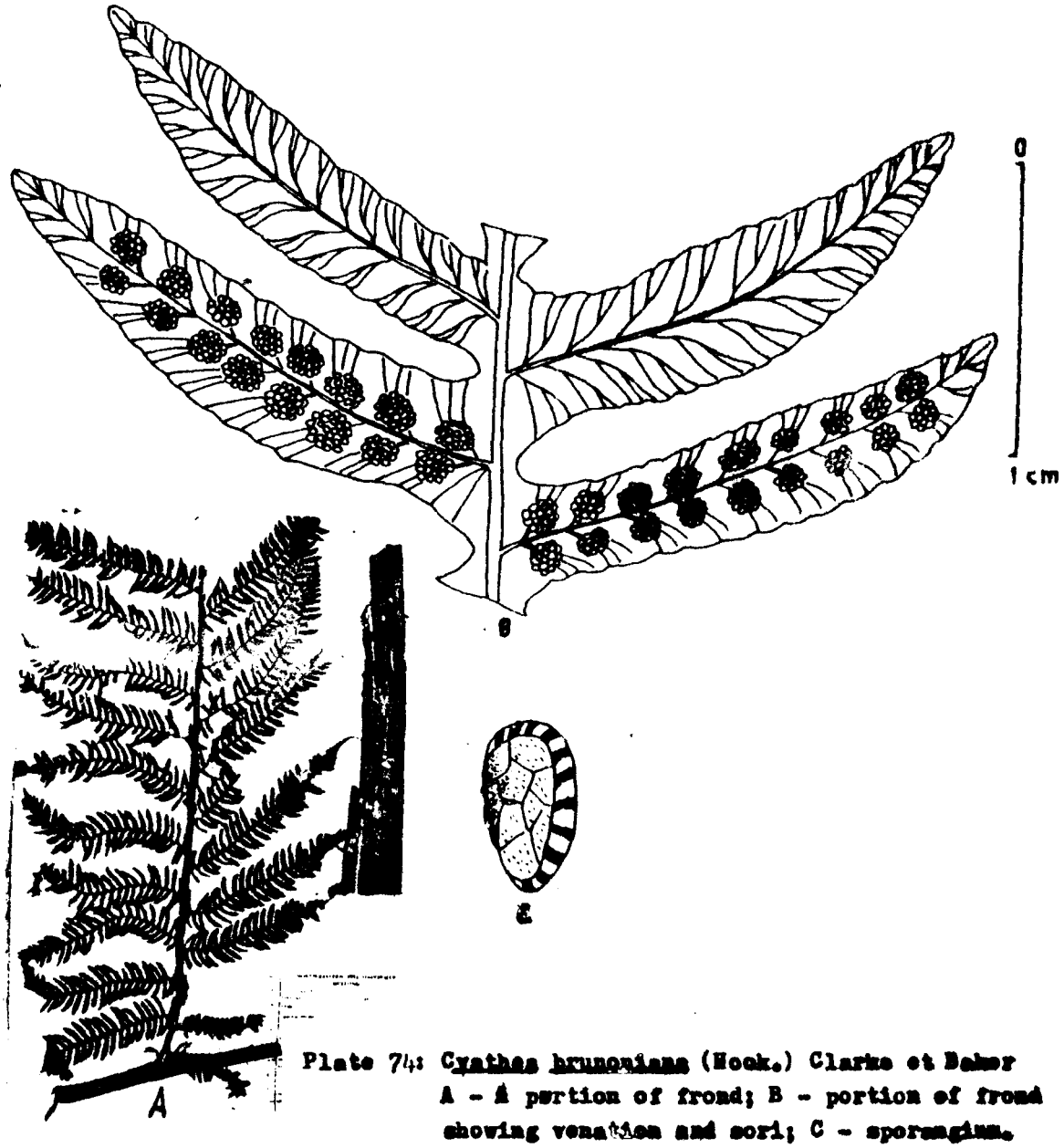


Plate 74: Cyathea brunoniana (Hook.) Clarke et Baker
A - A portion of frond; B - portion of frond showing venation and sori; C - sporangium.

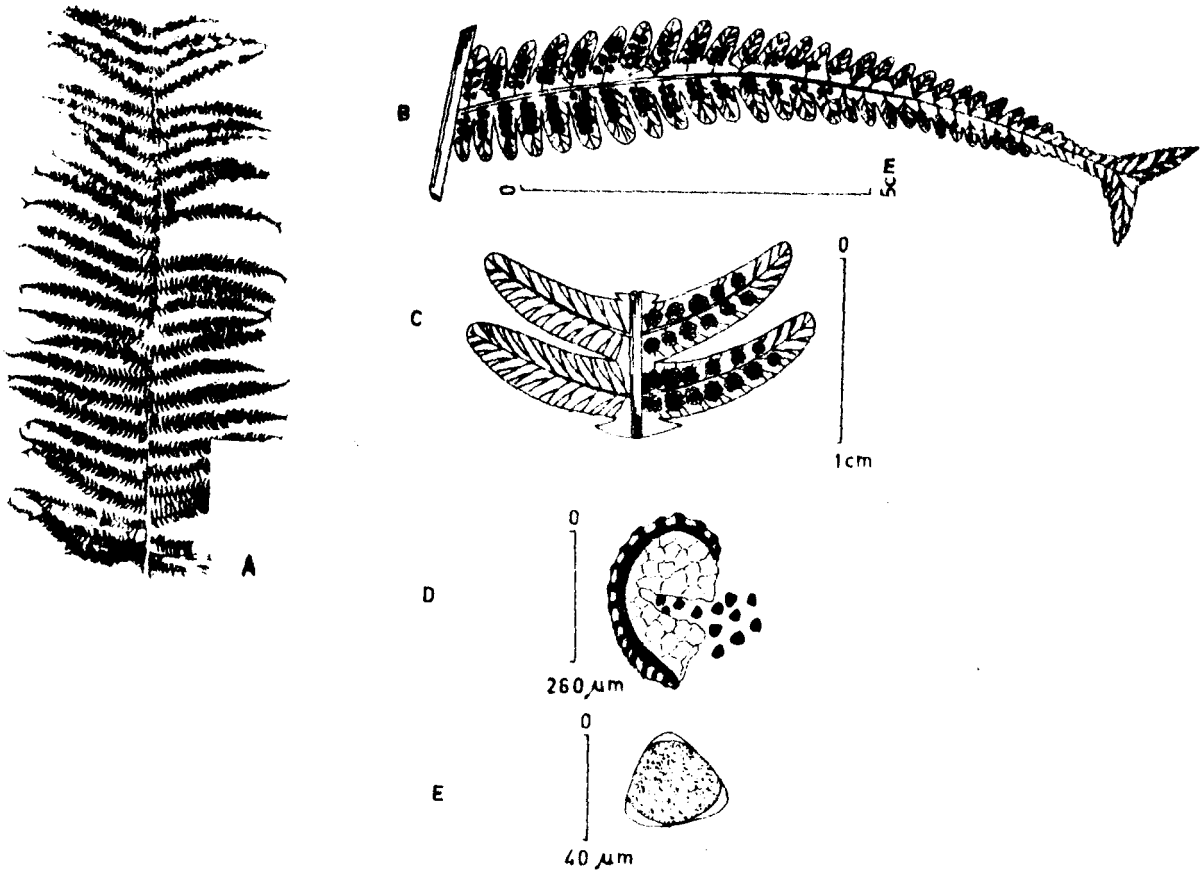


Plate 75: Cyathea holitumiana, sp. nov. A - Portion of frond; B - portion of fertile pinna; C - a portion of pinna with spores; E - spore enlarged.

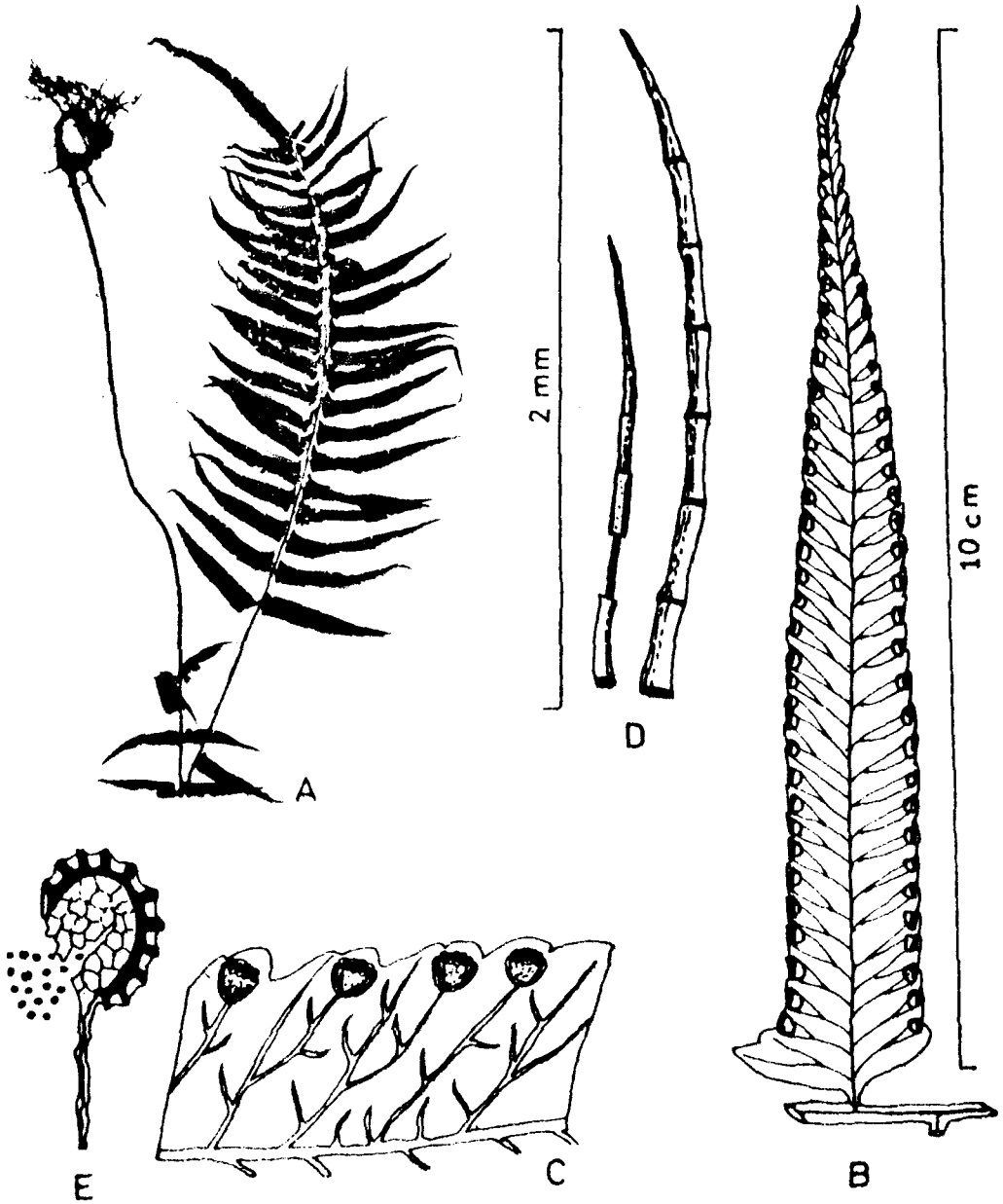


Plate 76: Microlepia hookeriana (Wall. ex Hook.) Presl. A - Habit; B - pinna showing venation and sori; C - portion of pinna enlarged; D - multicellular hairs from stipe and rhizome; E - sporangium.

Plate 77: Microlepia platyphylla (D.Don)J.Smith
A - Habit; B - a portion showing venation and sori; C - sorus with indusium; D - sporangium.

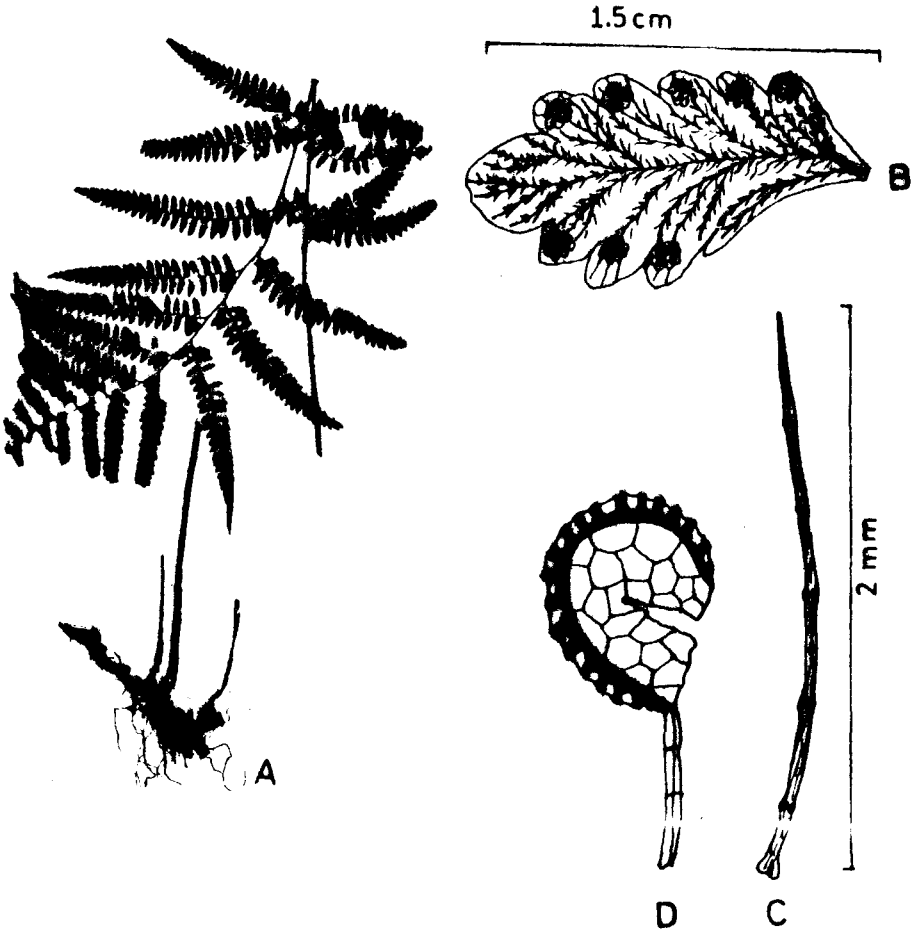


Plate 78: Microlepia strigosa (Thunb.) Presl. A - Habit;
B - pinna showing venation and sori; C - stipe scale;
D - sporangium.

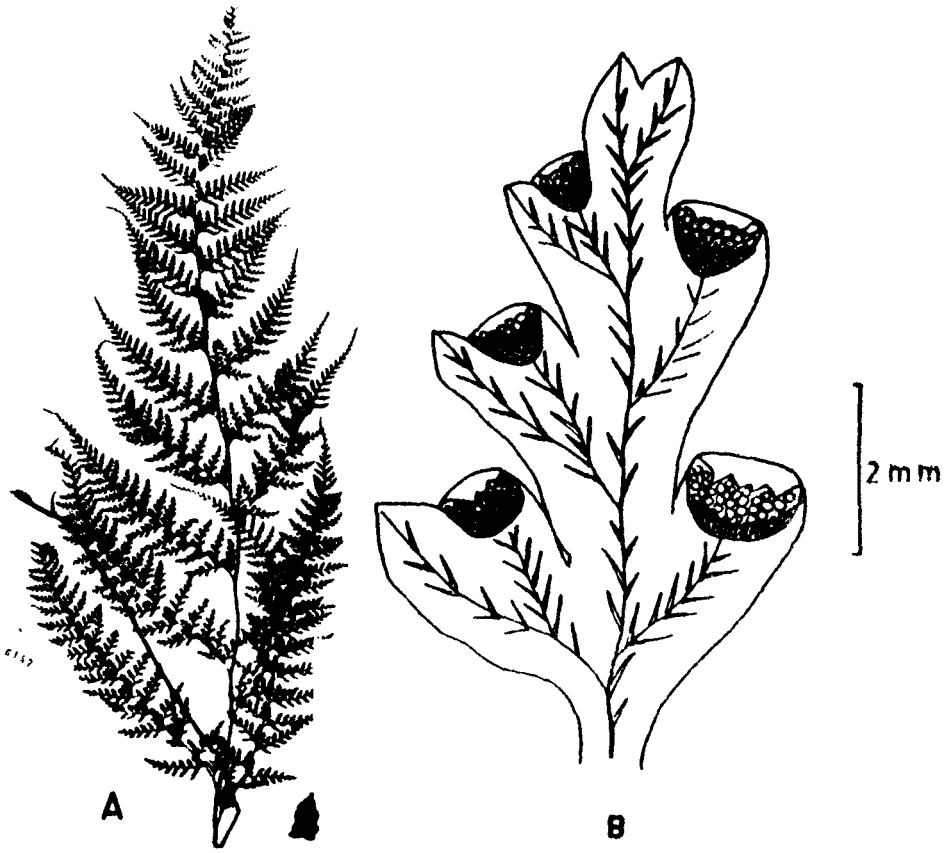


Plate 79: Microlepia trapeziformis (Roxb.) Kuhn
A- Habit; B- Pinnule enlarged.

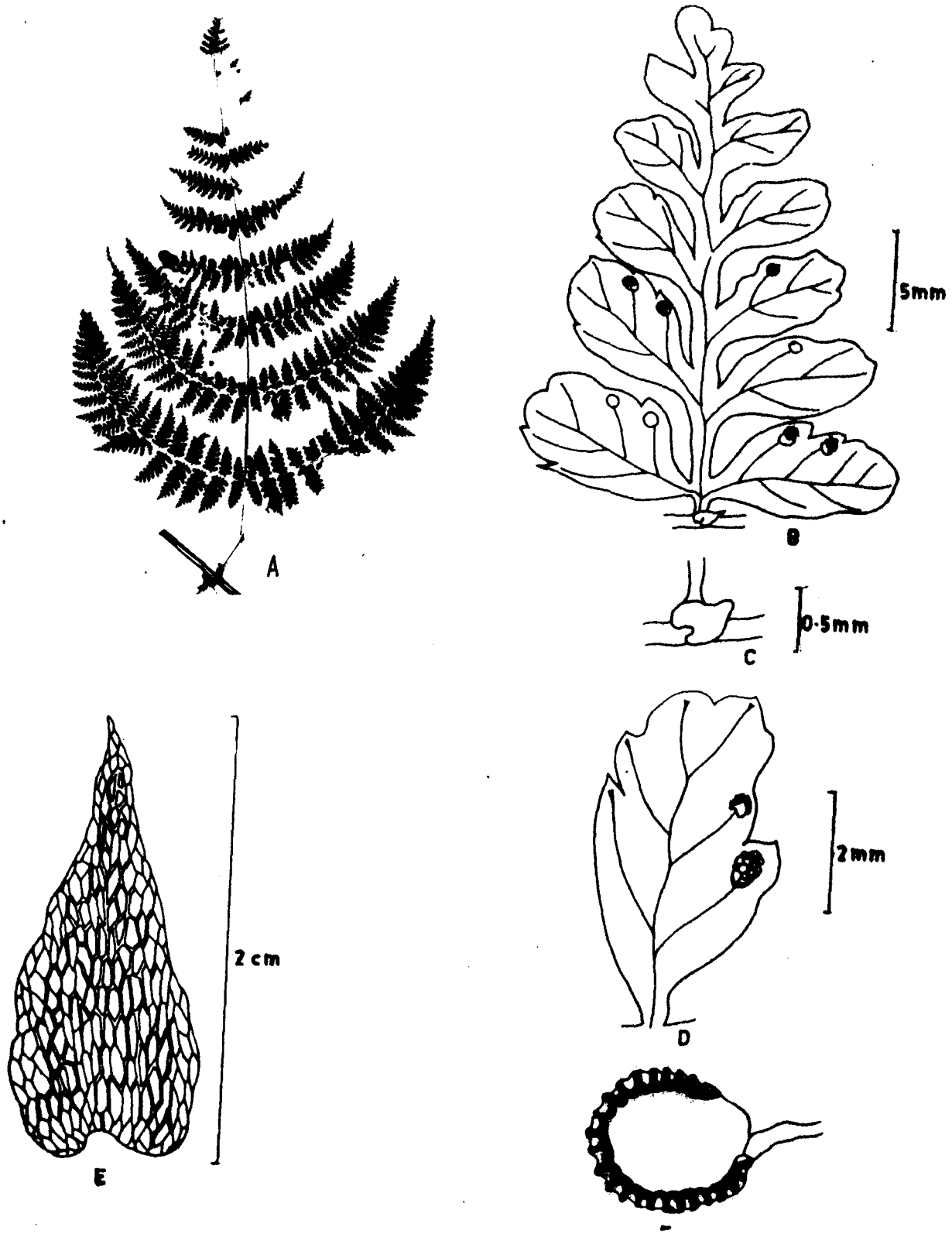


Plate 80: Monachosorum subdigitatum (Blume) Kuhn. A - a portion frond; B - a pinnule; C - basal scale of pinnule; D - a segment of pinnule enlarged; E - rhizome scale; F - sporangium.

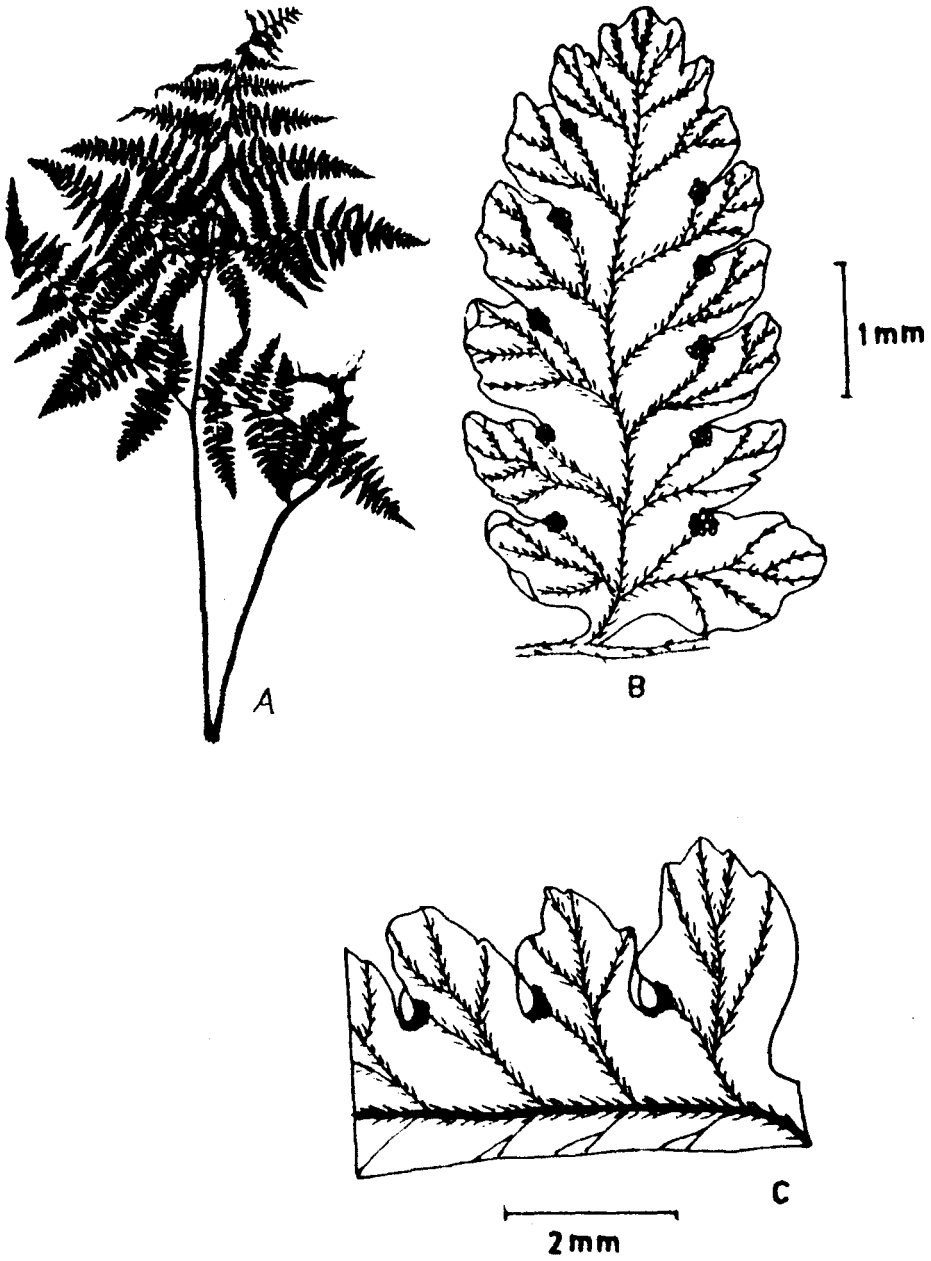


Plate 81: Hypolepis punctatum (Thunb.) Mett. ex Kuhn A - a portion of plant; B - pinnule enlarged; C- portion of pinnule.

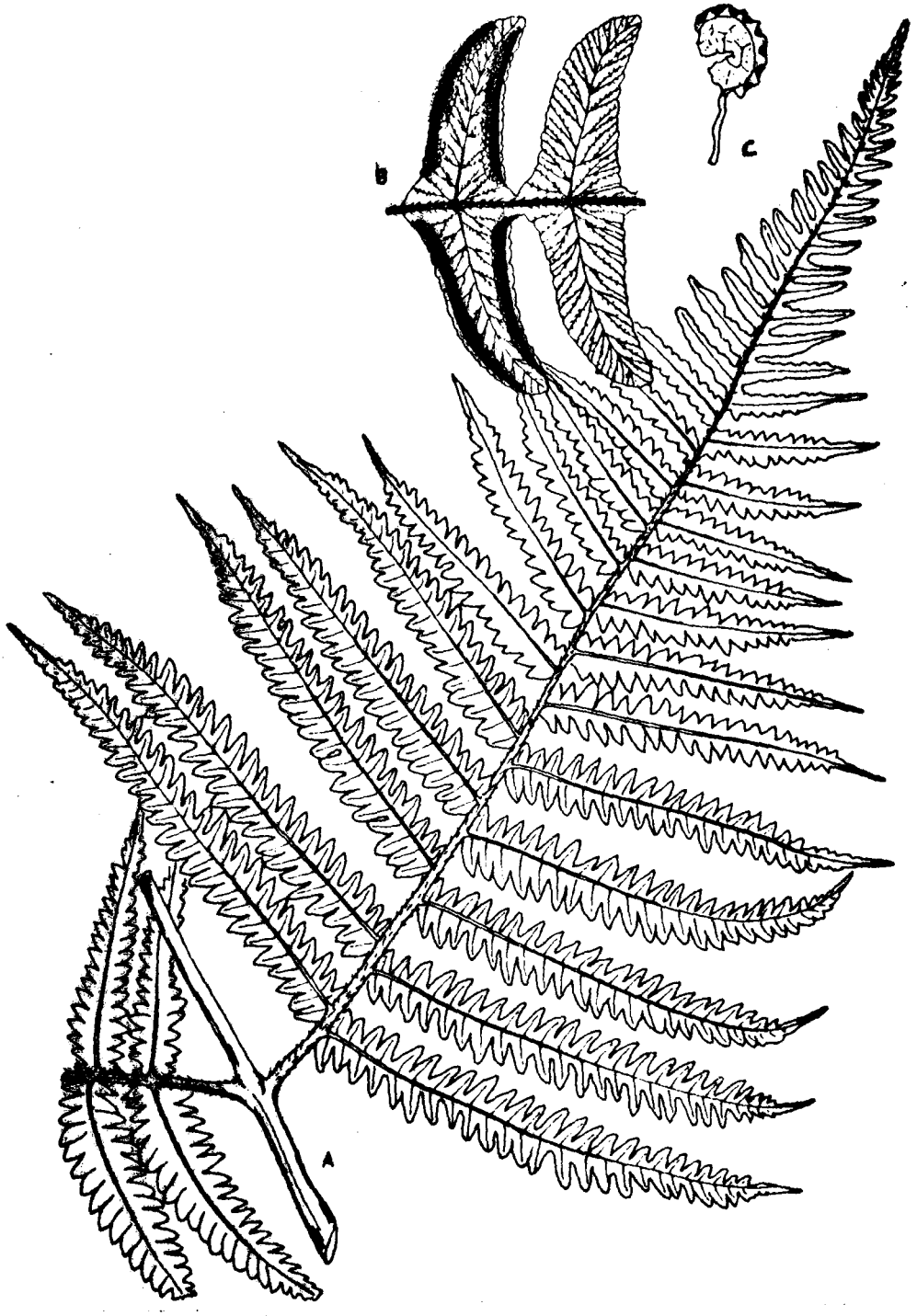


Plate 82: Pteridium aquilium (Linn.) Kuhn. A - A portion of frond; B - a portion of frond showing venation; C - sporangium.

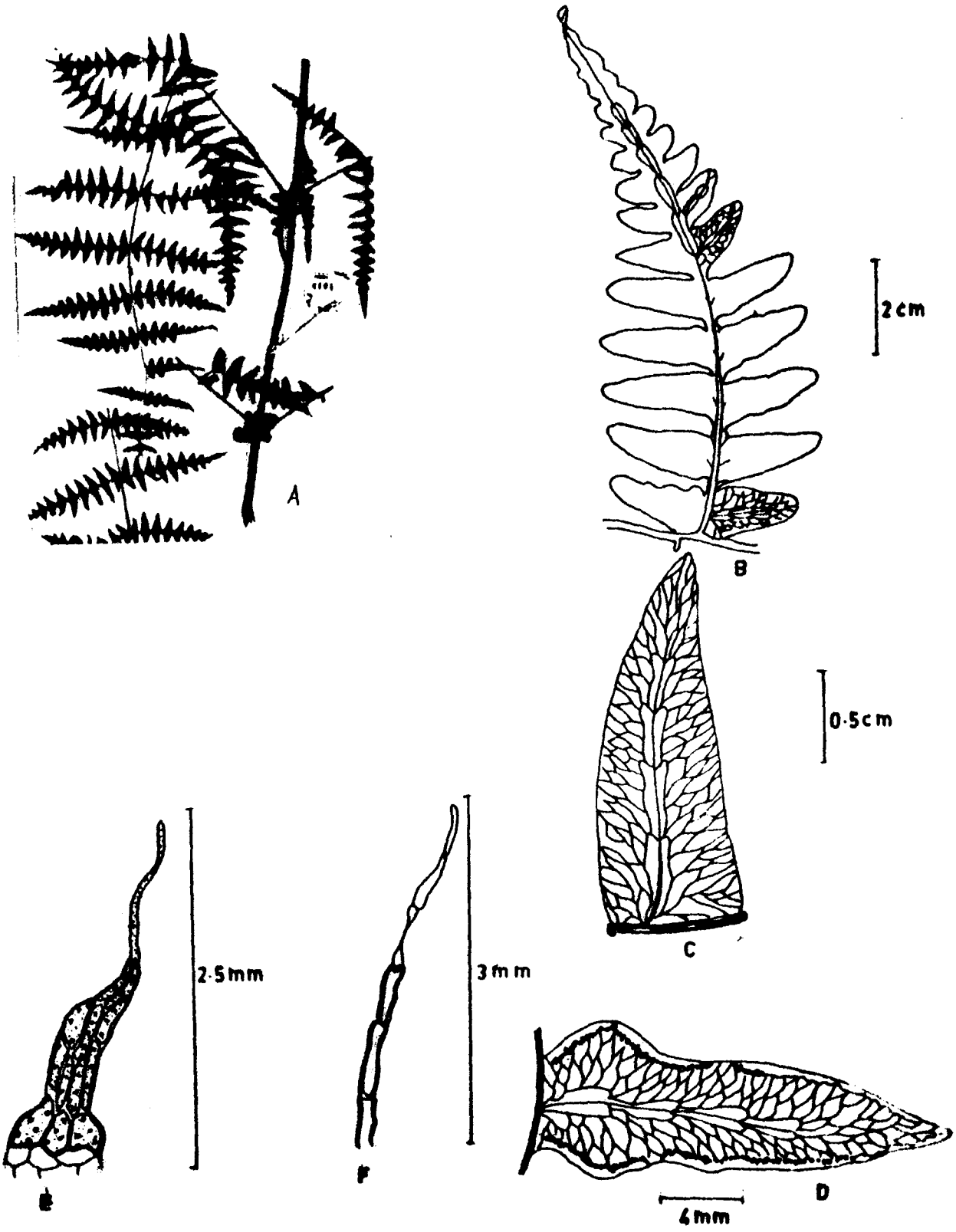


Plate 83: Histiopteris incisa (Thunb.) J.Smith A - Habit;
B - pinna; C - sterile pinnule; D - fertile pinnule;
E - rhizome scale; F - rhizome hair.

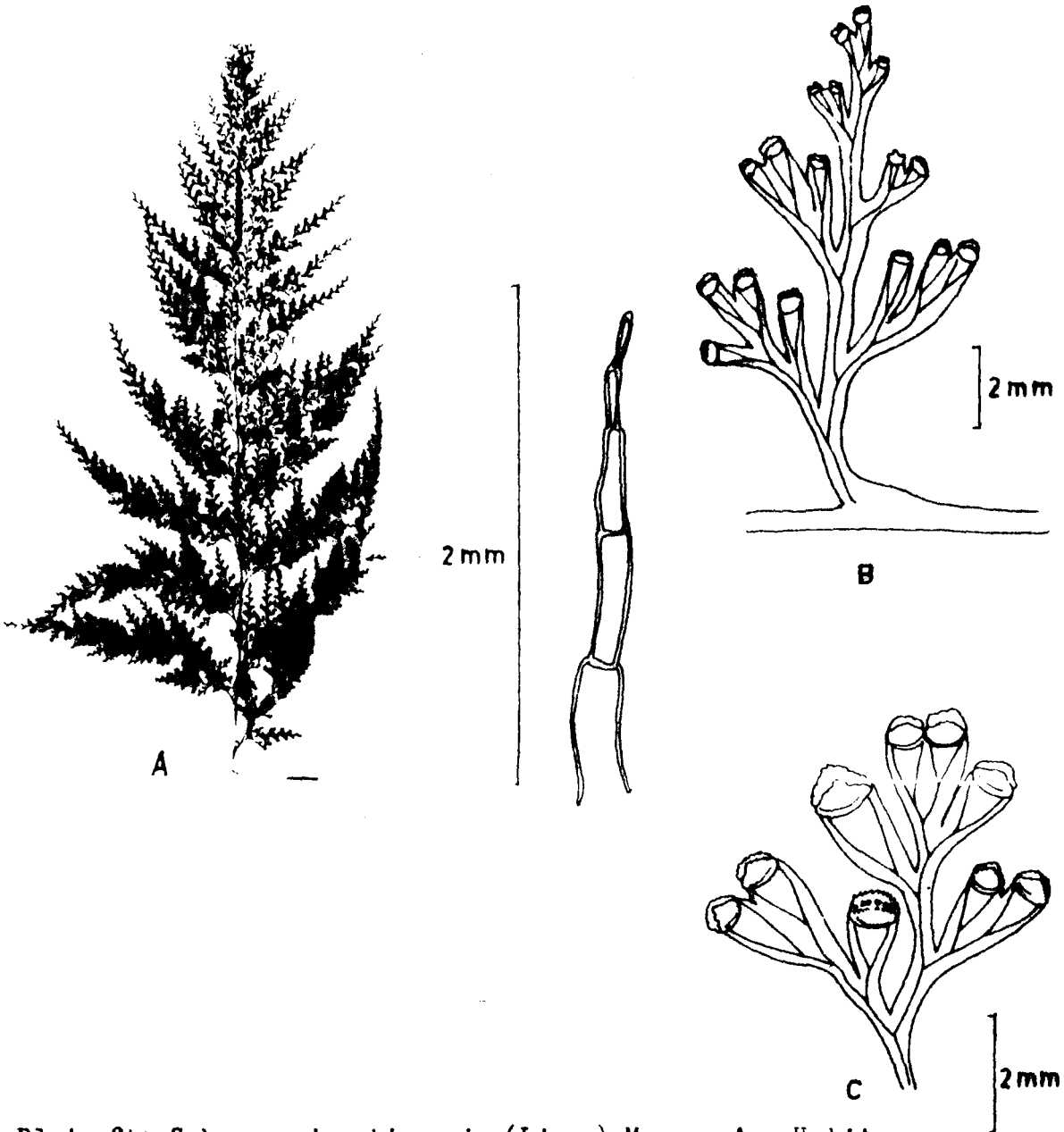


Plate 84: Sphenomeris chinensis (Linn.) Maxon A - Habit; B & C - portion of frond enlarged; D - rhizome hair.

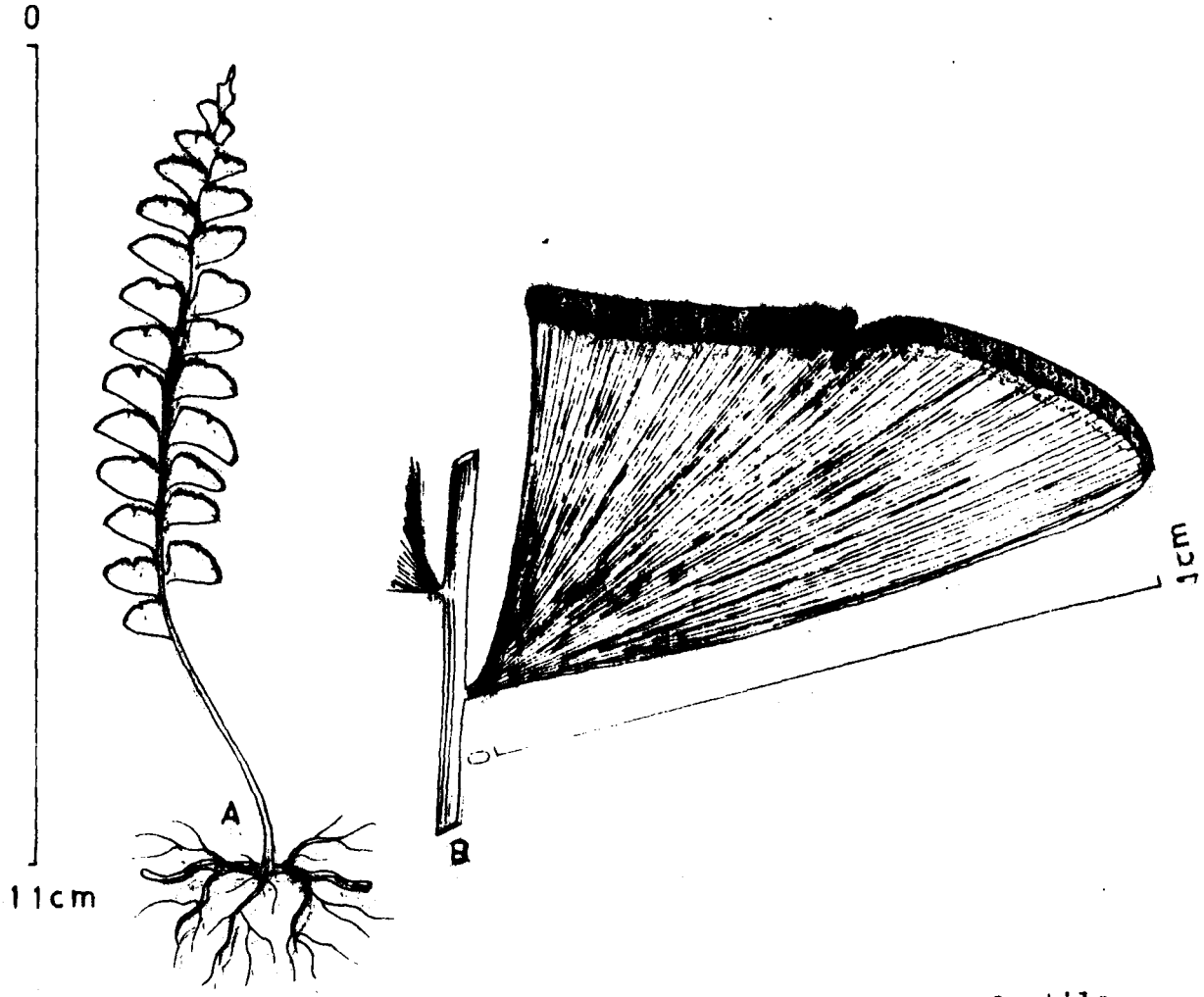


Plate 87: Lindsaea himalaica Kramer A - Habit; B - fertile pinna.

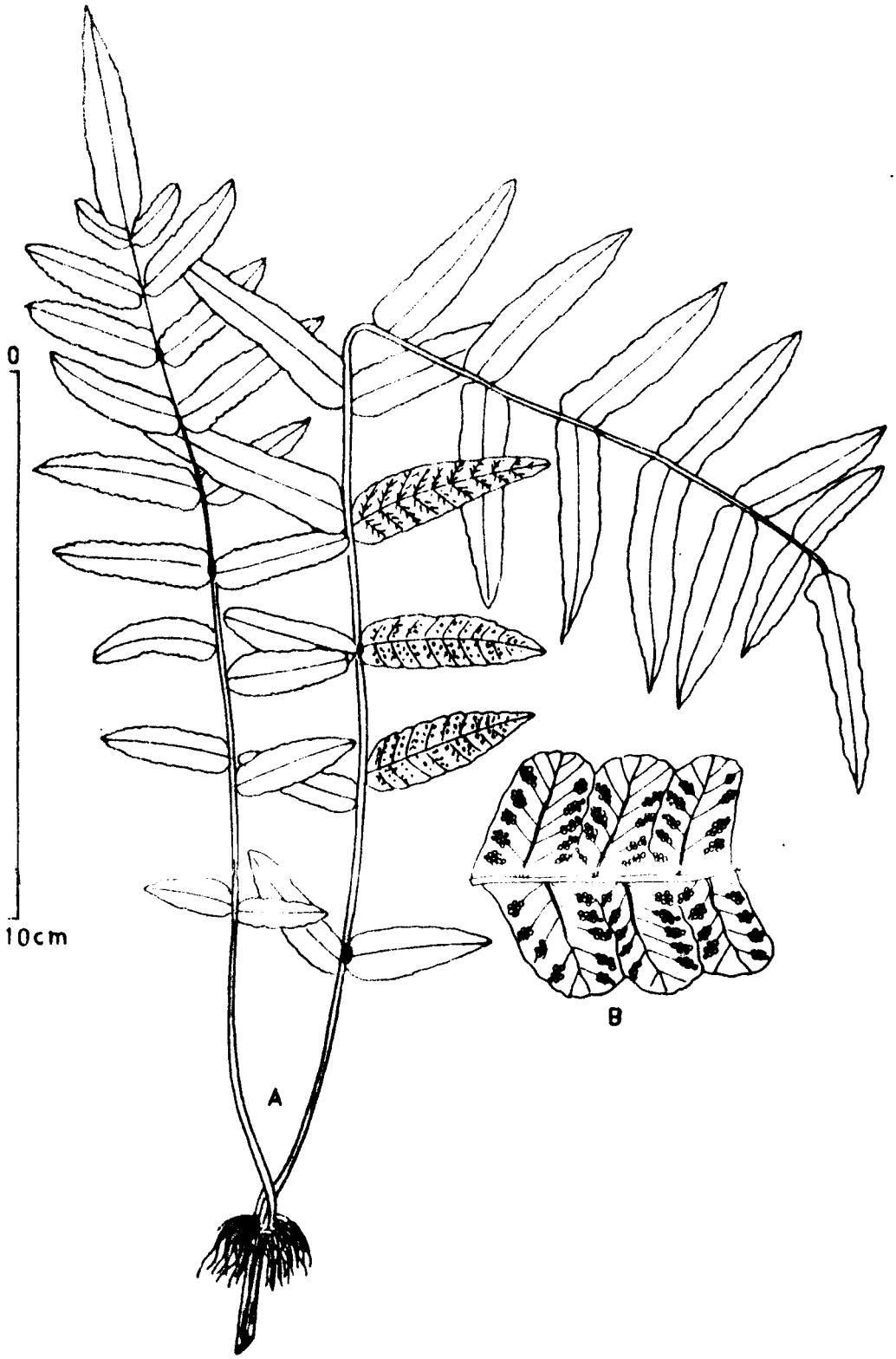


Plate 87a: Ampelopteris prolifera (Retz.) Copel. A - Habit; B - a portion of pinna enlarged showing sori and venation.

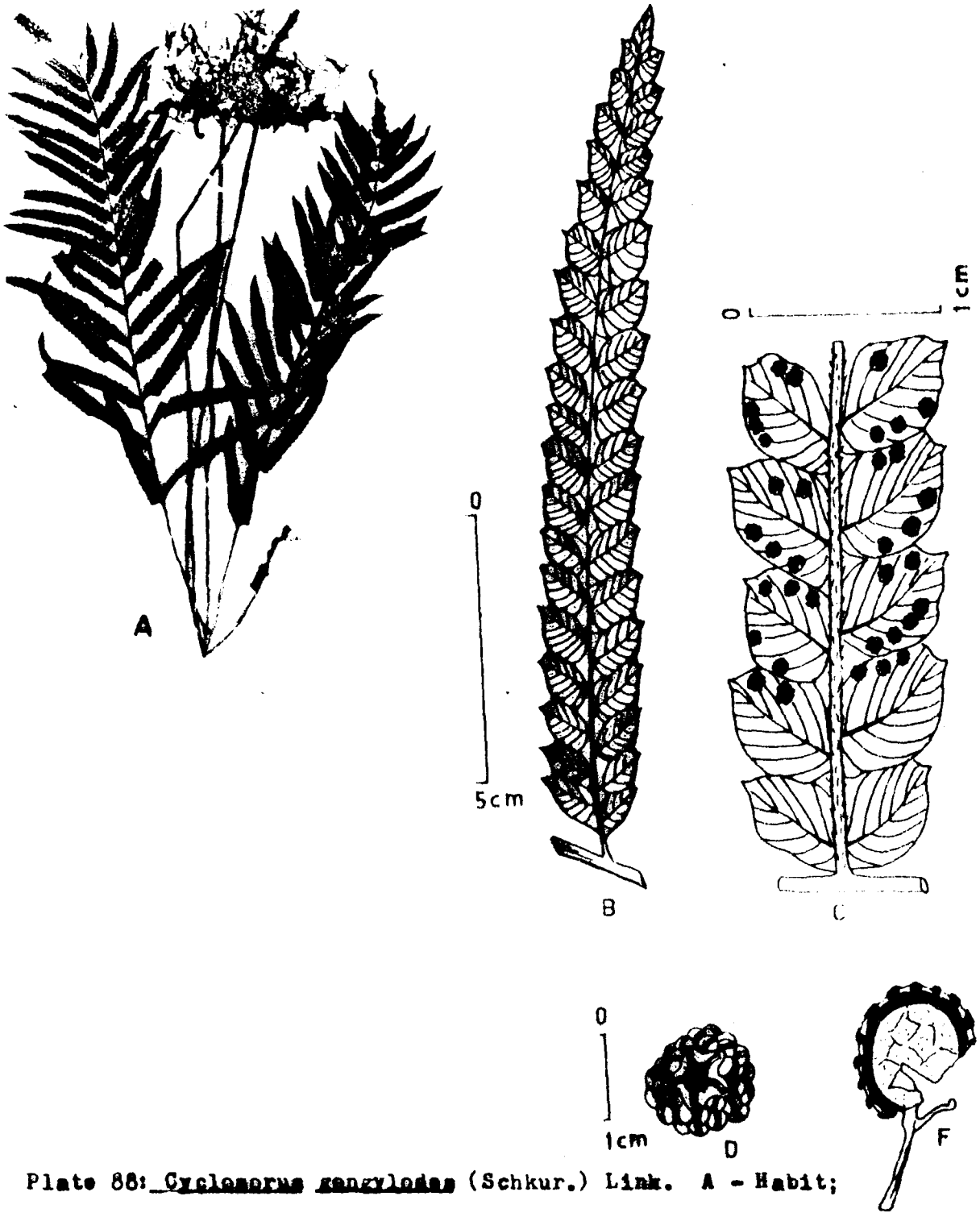


Plate 88: Cyclosorus gongylodes (Schkur.) Link. A - Habit;
B - Sterile pinna; C - a portion of fertile pinna;
D - sorus; E - sporangium.

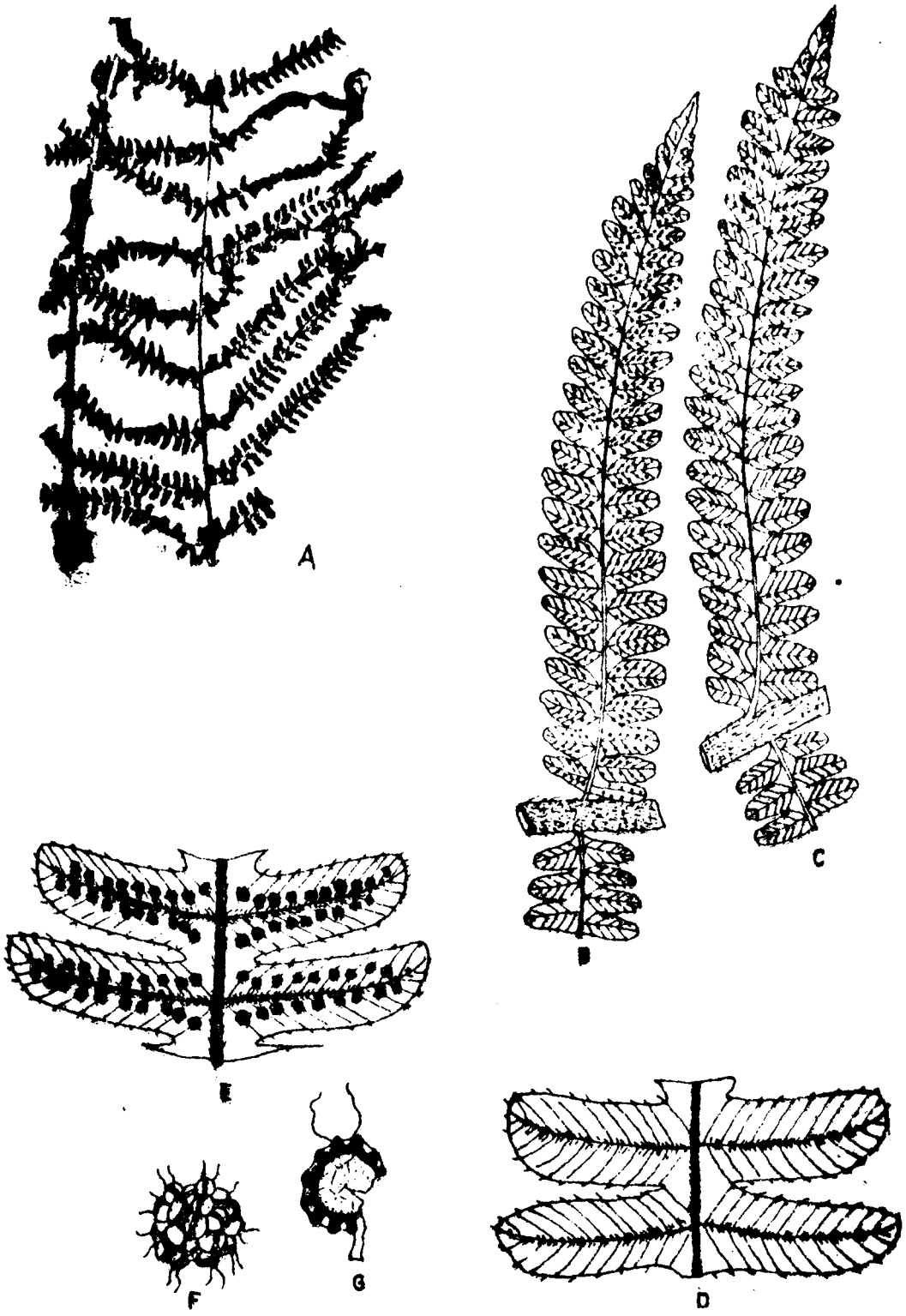


Plate 89: Cyclogramma auriculata (J.Smith) Ching. A - Habit; B - fertile pinna; C - sterile pinna; D - a portion of sterile pinna showing venation; E - a portion of fertile pinna with sori; F - soras; G - sporangium.

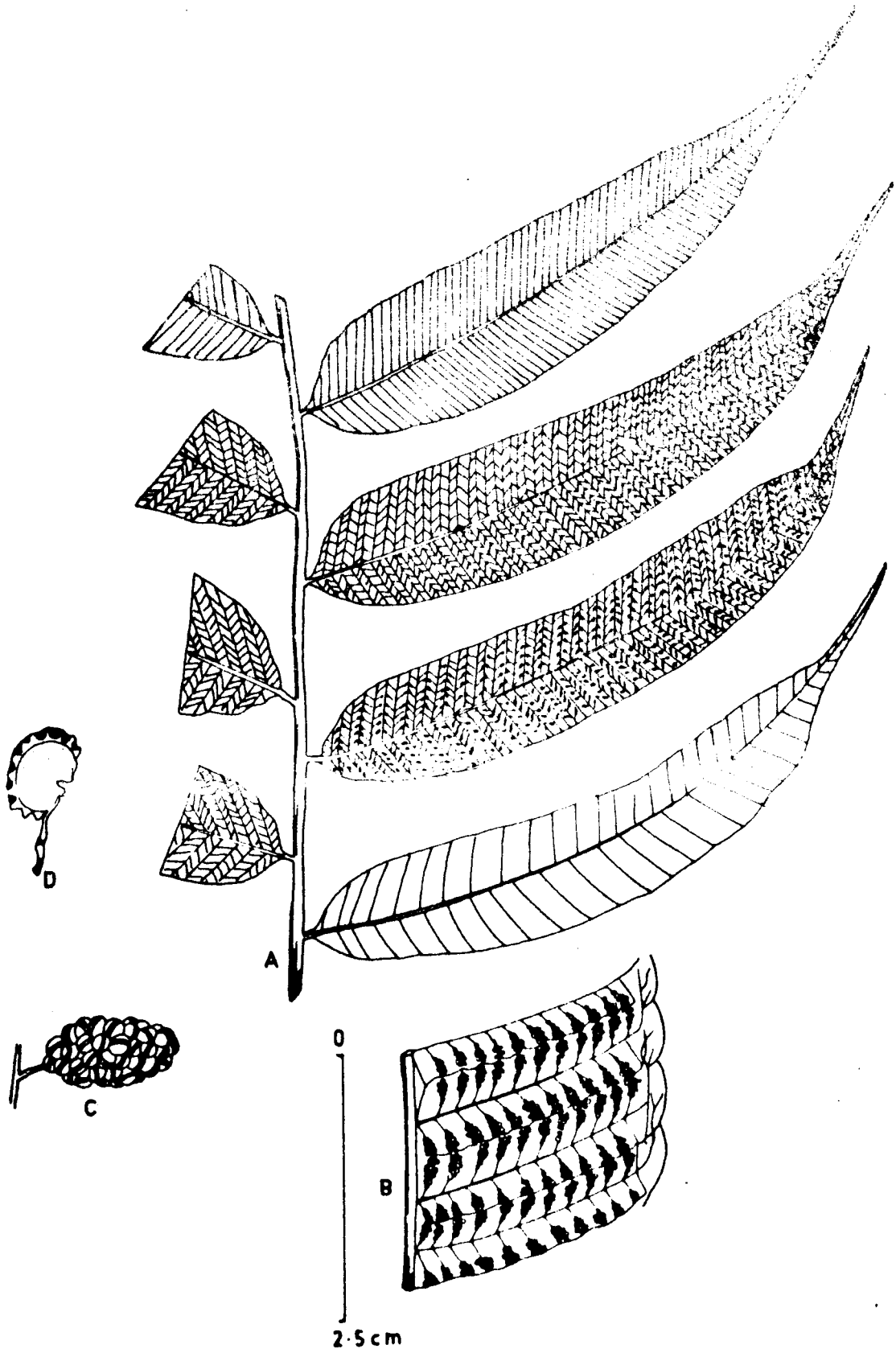


Plate 90: Pronephrium lakhimpurense (Rose) Holttum A- A portion of frond; B- a portion of pinna enlarged; C- sporangium.

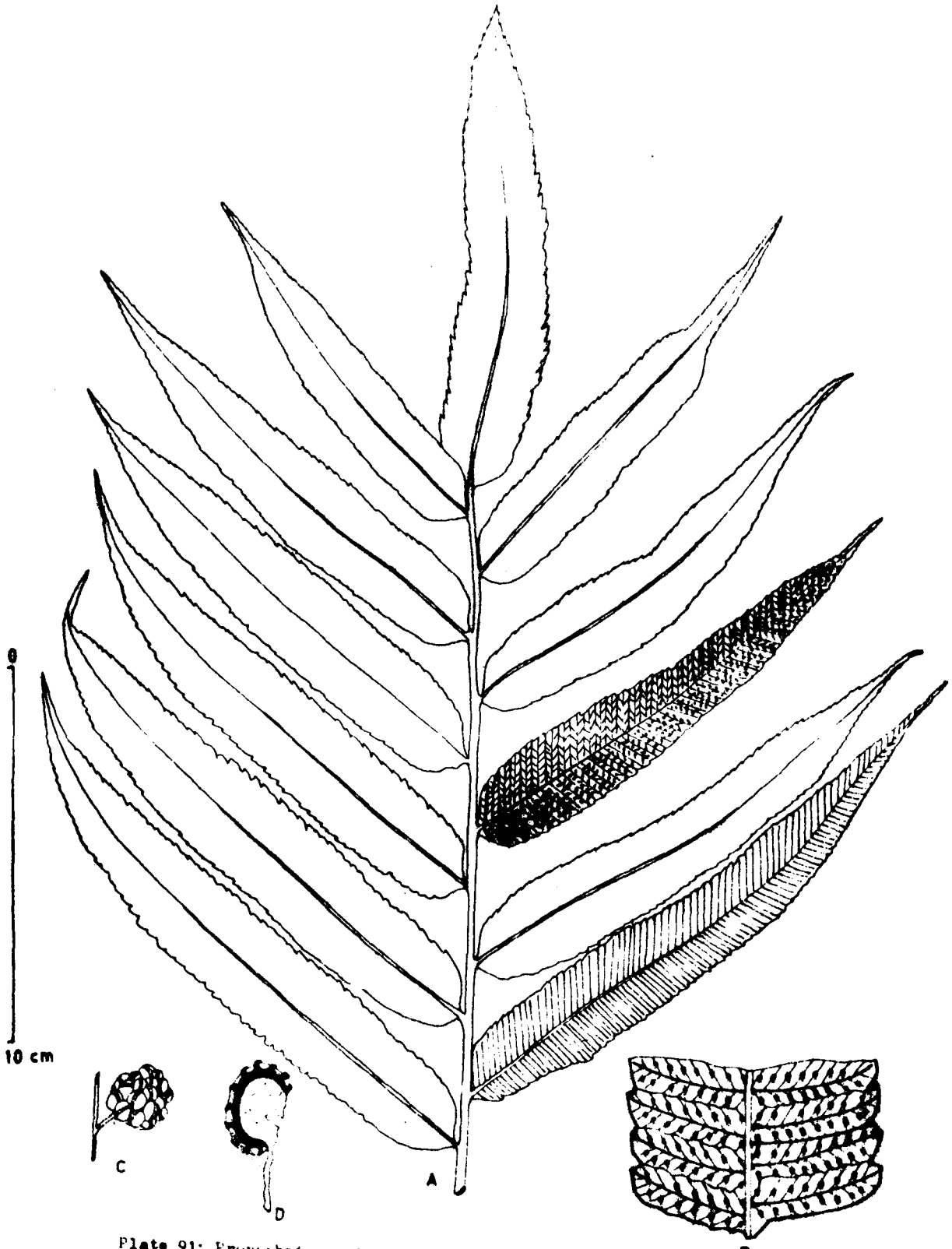


Plate 91: Pronephrium nudatum (Roxb.) Holttum A - Habit; B - a portion of pinna enlarged to show sori and venation; C - sorus; D - sporangium.

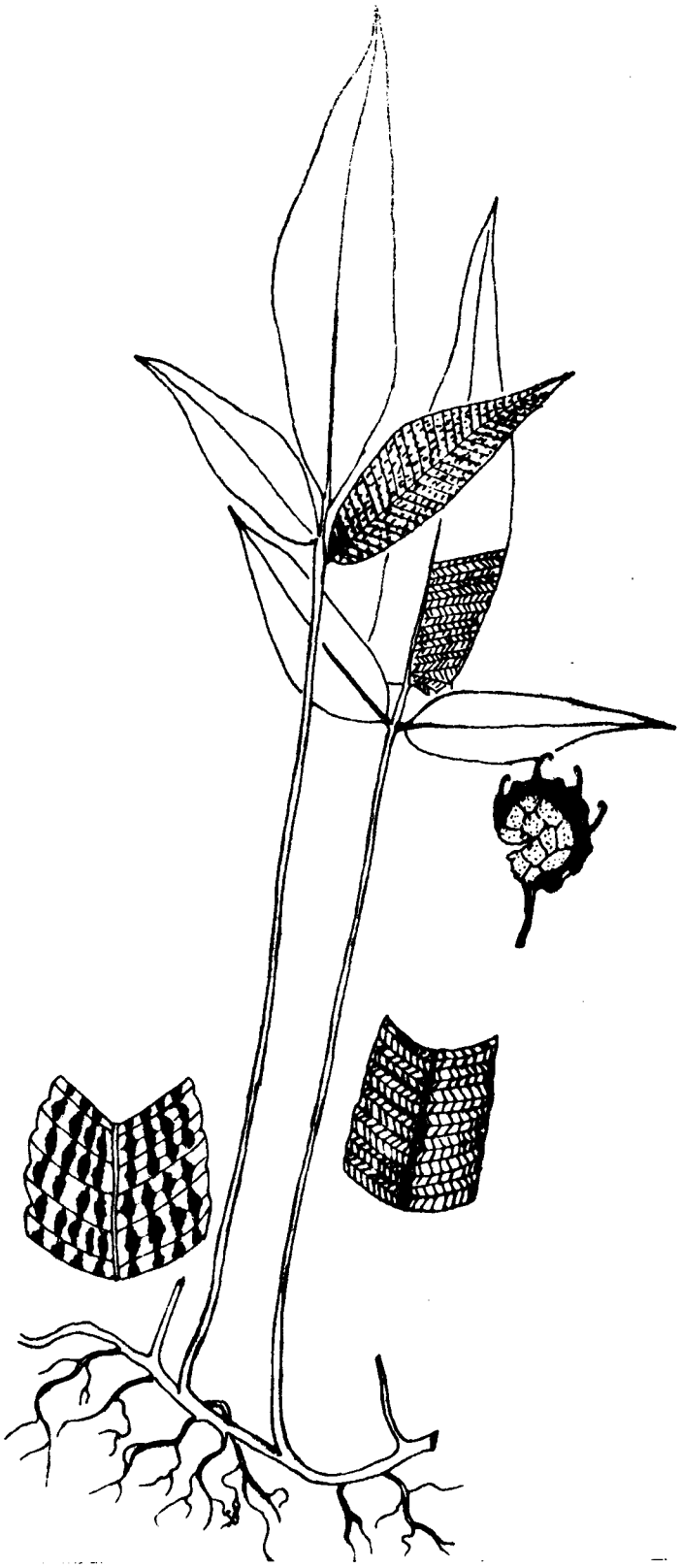


Plate 92: Pronephrium trichylum (Sw.) Holttum A - Habit; B- a portion fertile pinna showing the arrangement of sori; C - a portion of sterile pinna showing the venation; D - sporangium.

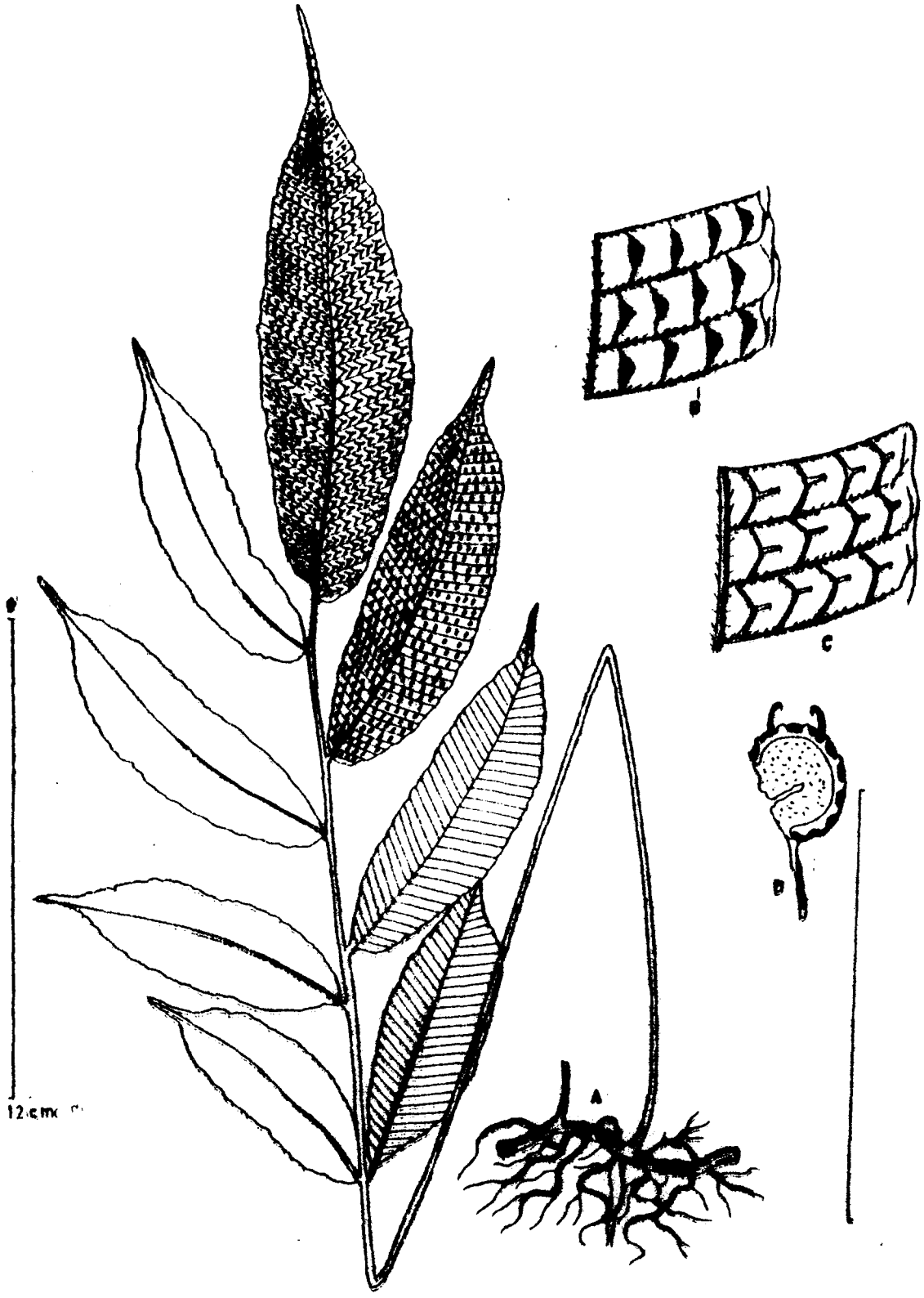


Plate 93: Pronephrium triphyllum var. parishii (Bedd.) Nug
A - Habit; B - a portion of fertile pinna showing veri
C - a portion of sterile pinna showing venation;
D - sporangium.

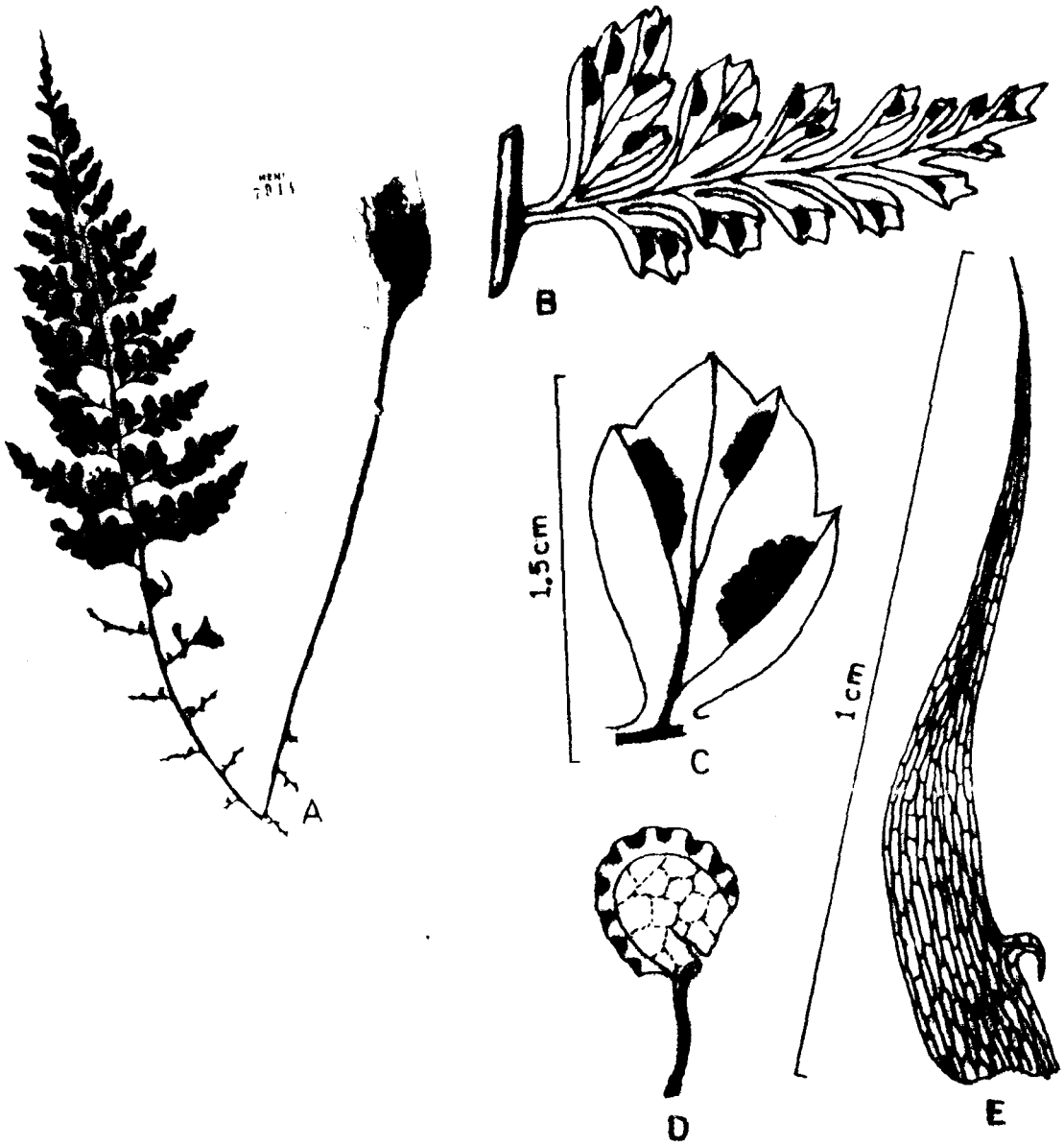


Plate 94: Asplenium bullatum Wall. ex Mett. A - Habit; B - fertile pinna; C - pinnule showing venation & sori; D - sporangium; E - rhizome.

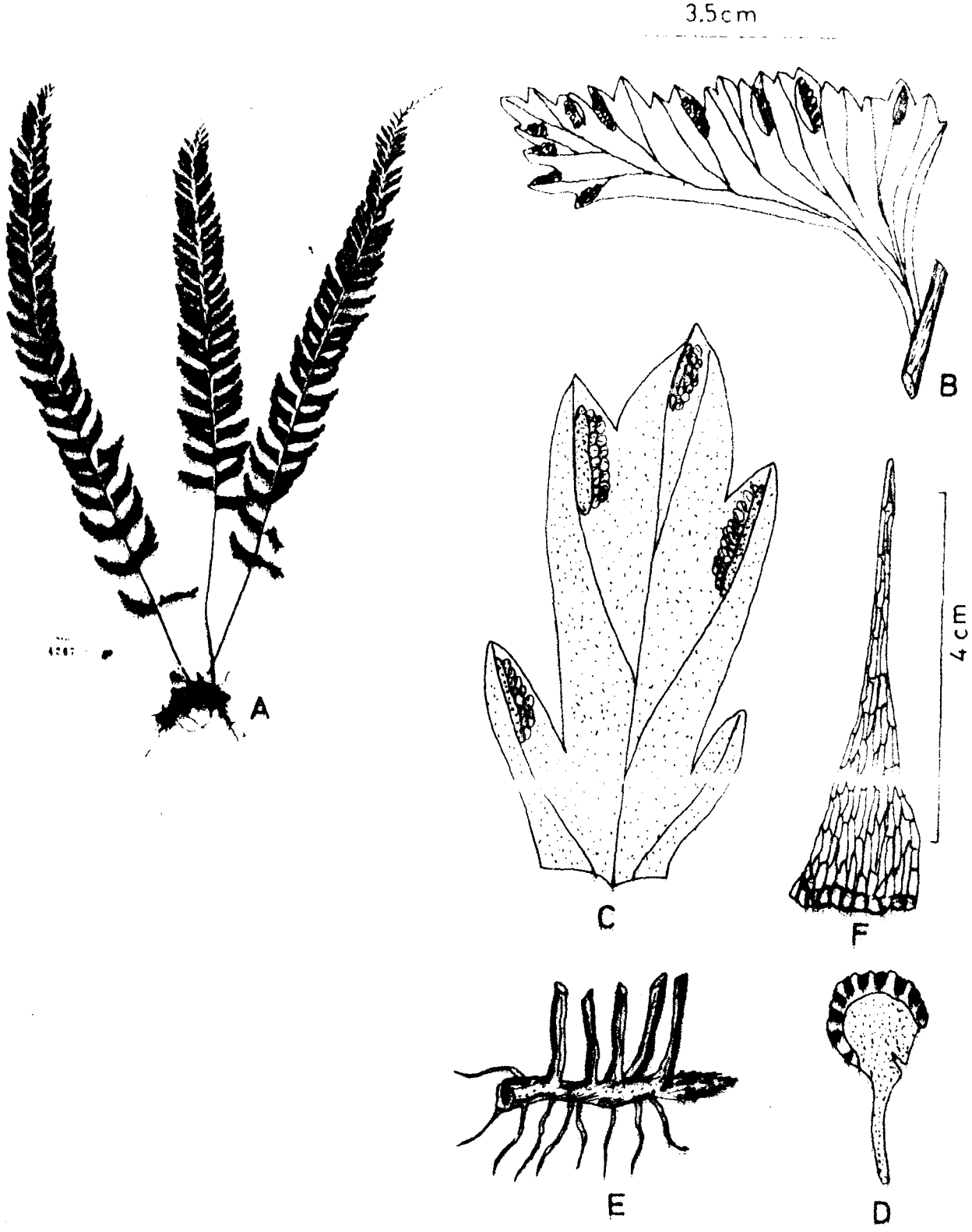


Plate 95: Asplenium cheilosorum Kuntze A - Habit; B - fertile pinna; C a portion of pinna enlarged; E - a portion to show sori and venation; D - sporangium; E - a portion of rhizome; F - rhizome scale.

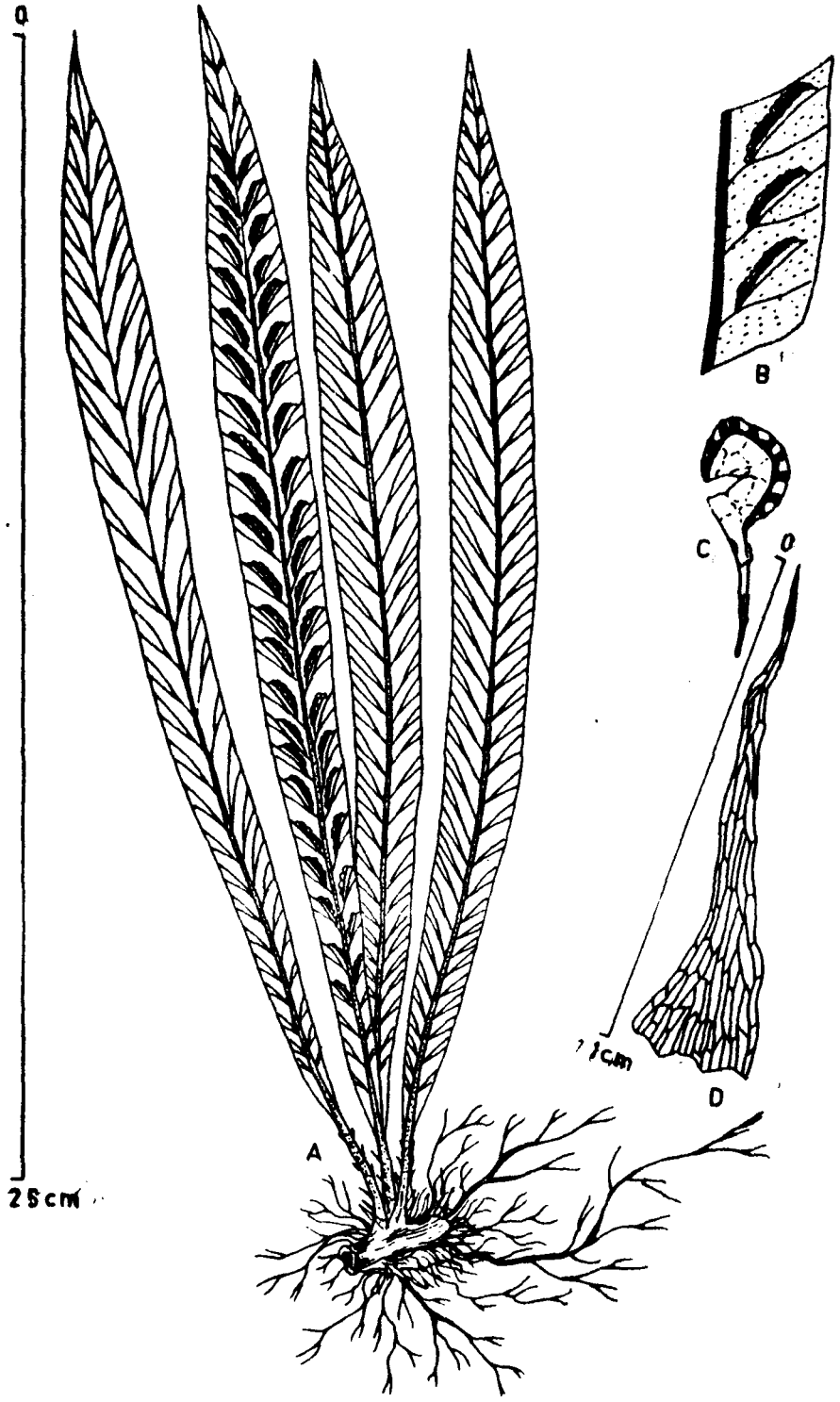


Plate 96: Asplenium ensiformis Wall. ex Hook. & Grev.
A - Habit; B - portion of frond showing venation and sori; C - sporangium; D - rhizome scale.

Plate 96A Asplenium finlaysonianum Hook. A - Habit; B - sori and venation; C - sporangium; D - rhizome scale.

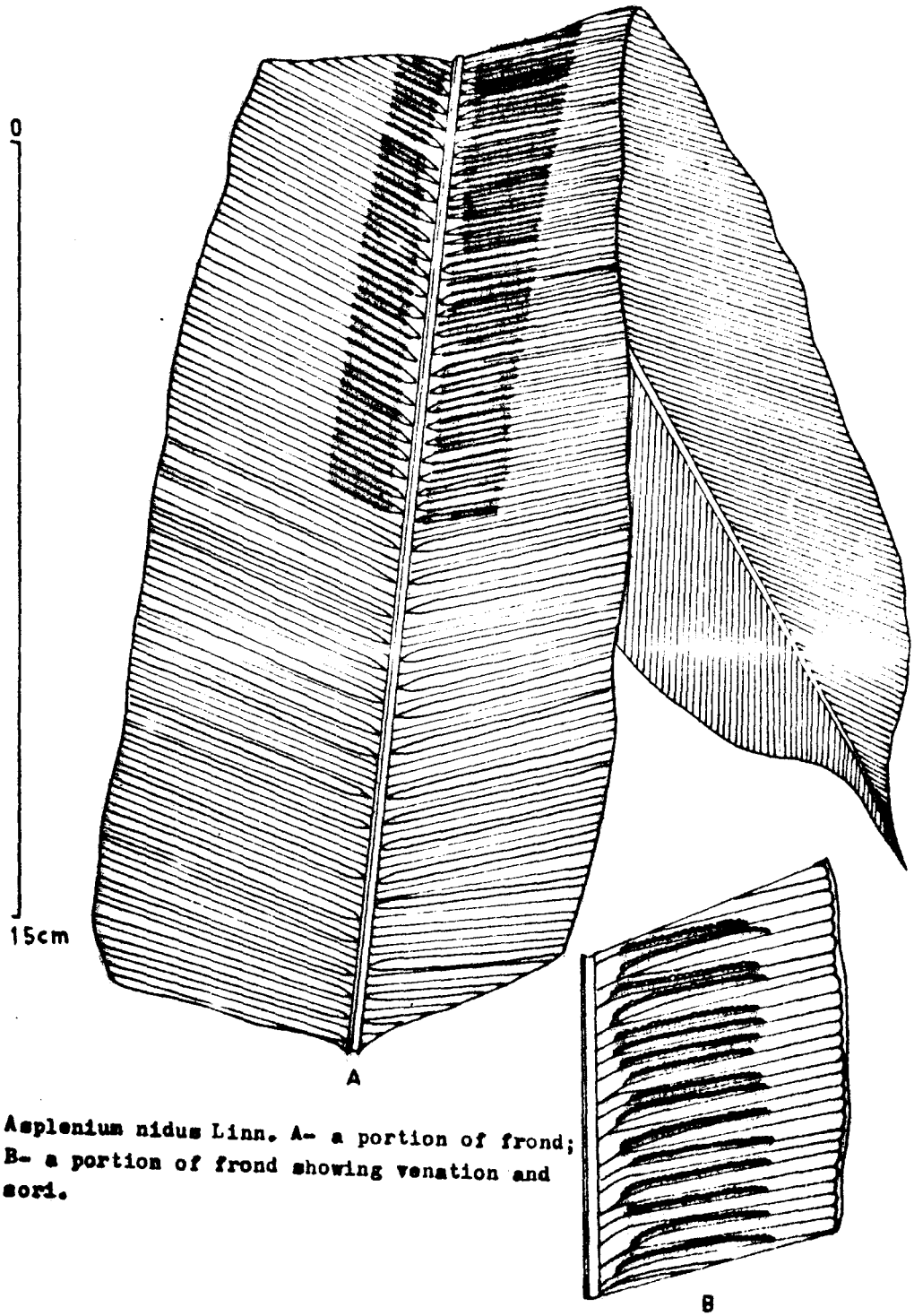


Plate 97: Asplenium nidus Linn. A- a portion of frond; B- a portion of frond showing venation and sori.

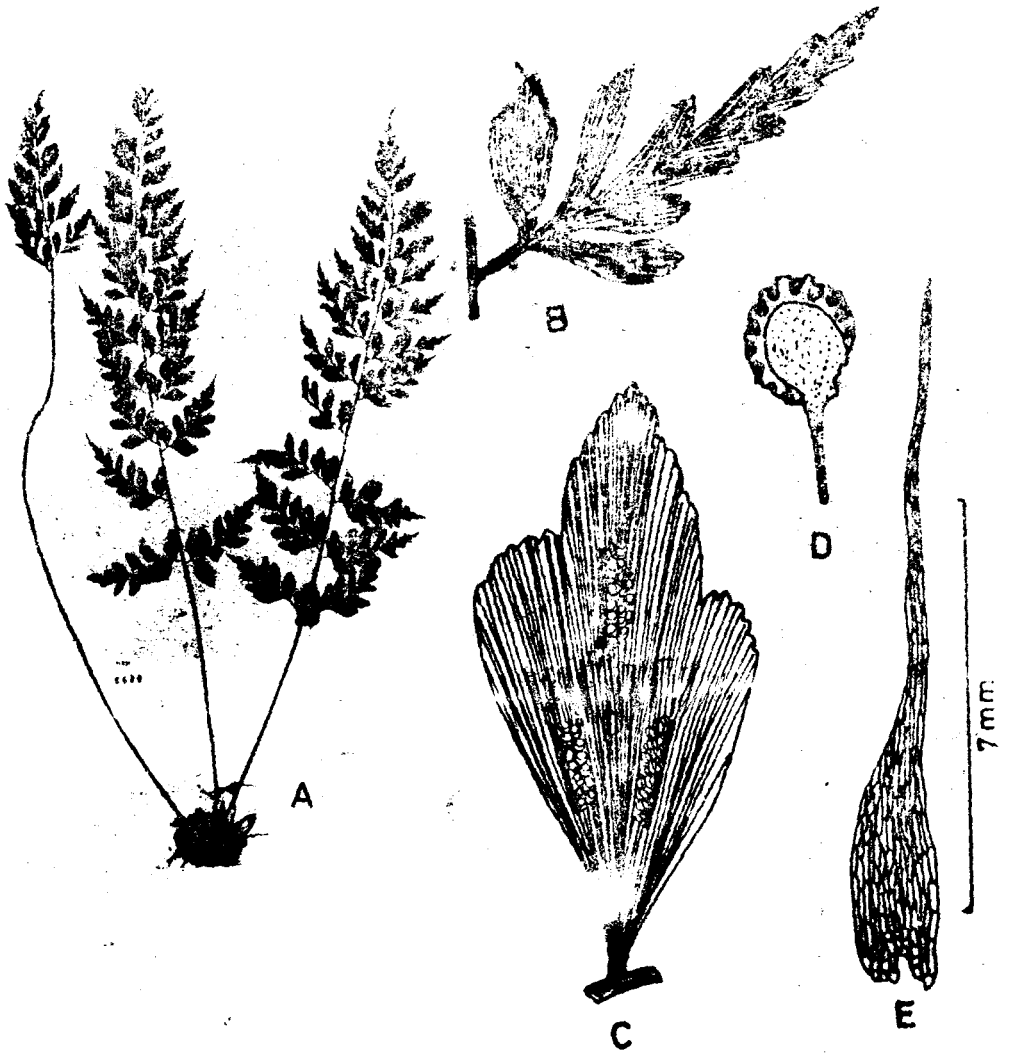


Plate 98: Asplenium nitidum Sw. A - Habit; B - fertile pinna; C - pinnule with sori; D - sporangium; E - rhizome scale.

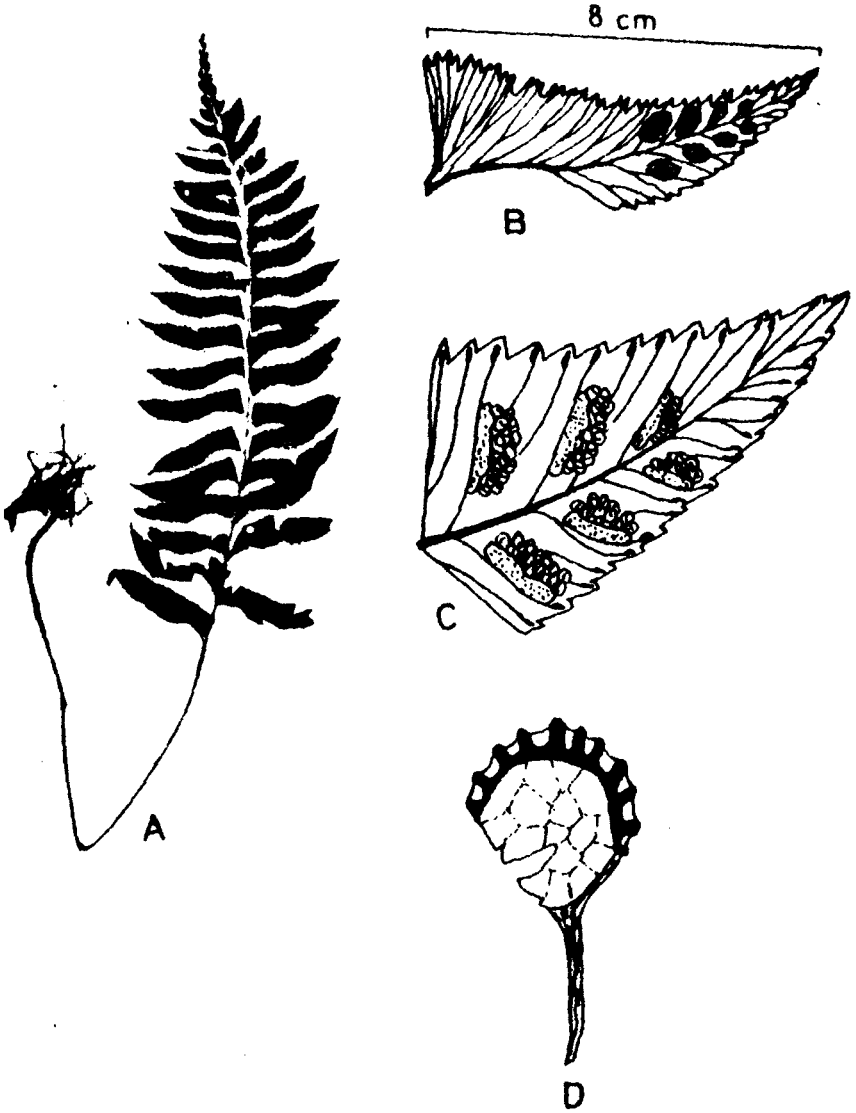


Plate 9[illegible] *Asplenium unilaterale* Lamk. A - Habit; B - fertile pinna; C - a portion of pinna enlarged showing sori and venation.

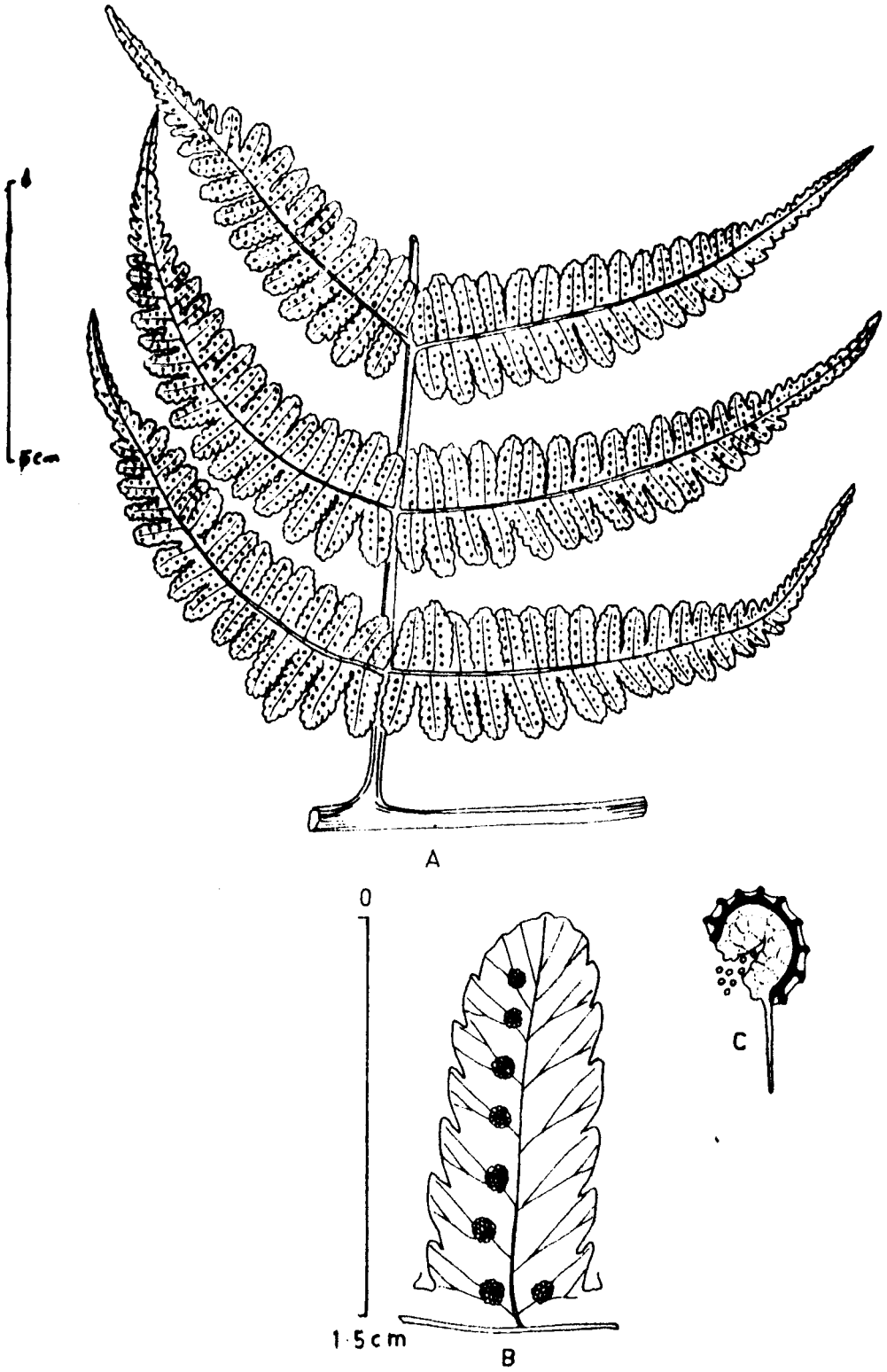


Plate 101: Dryoathyrium boryanum (Willd.) Ching A - Habit; B - pinnule with venation and sori; C - sporangium.

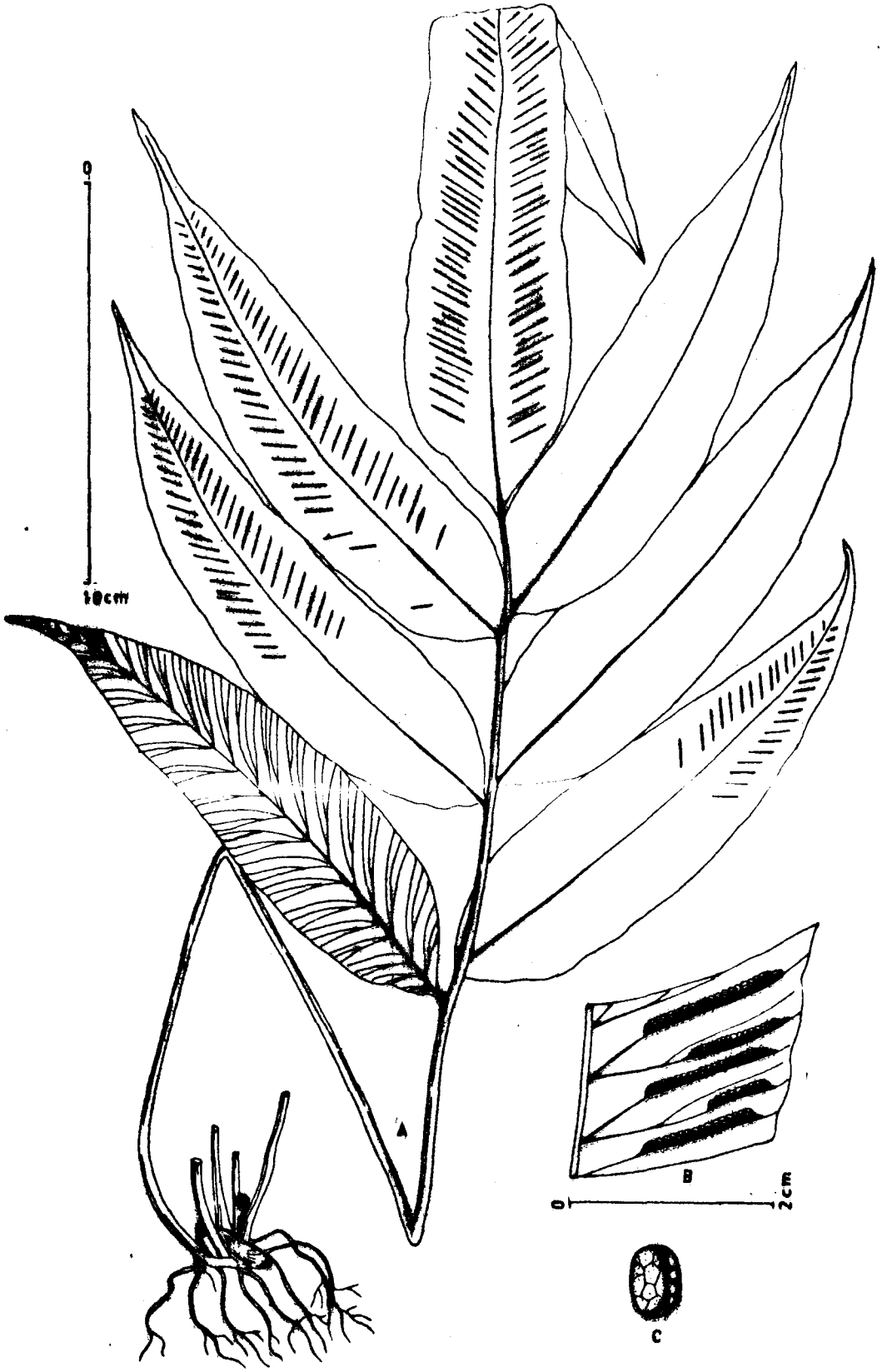


Plate 102: Diplazium bantamense Blume A - Habit; B - a portion of pinna; C - sporangium.

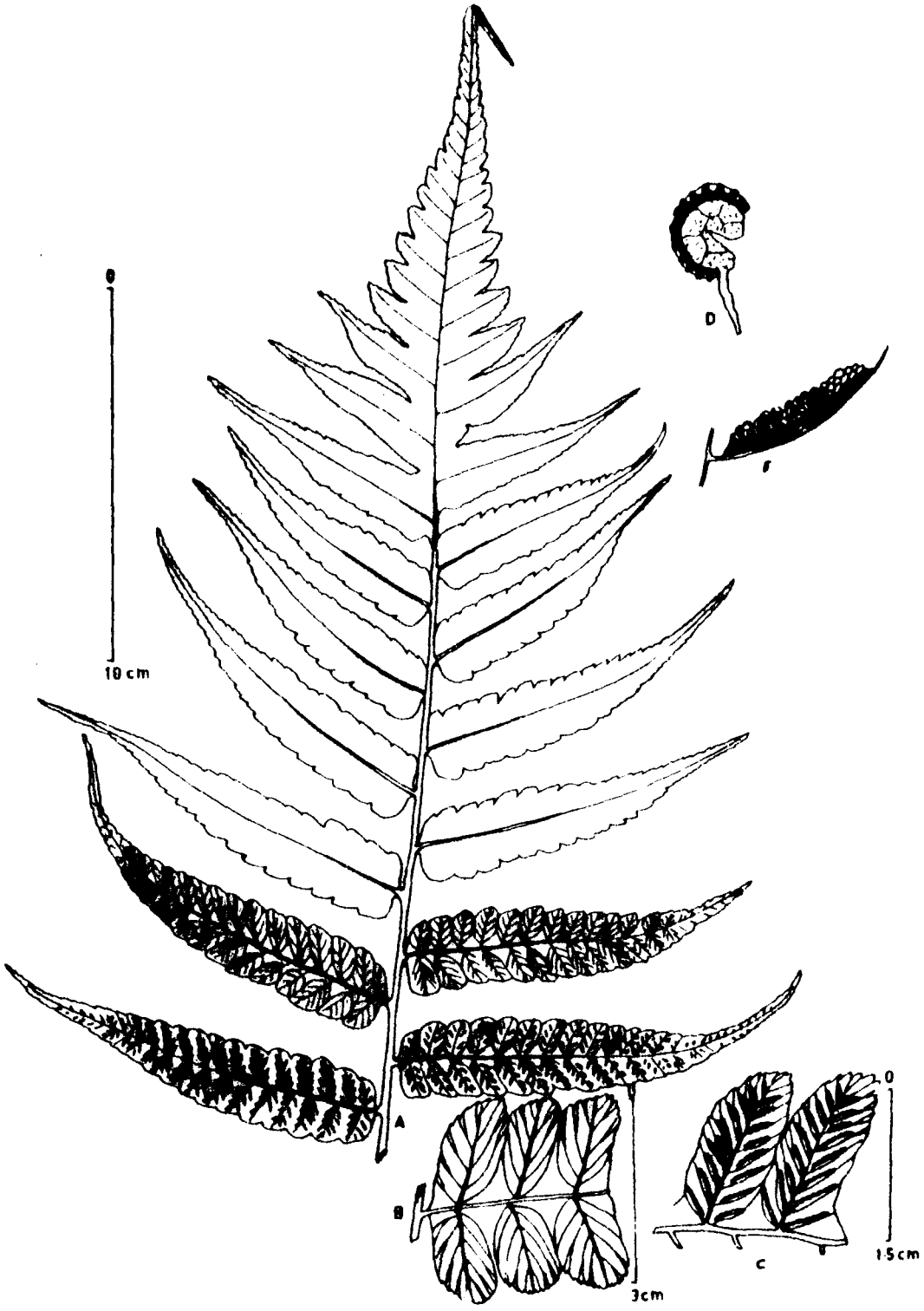


Plate 103: Diplazium esculentum (Retz.) Sw. A- a portion of frond; B- a portion of sterile pinna; C- a portion of fertile pinna; D- sporangium; E- sorus.

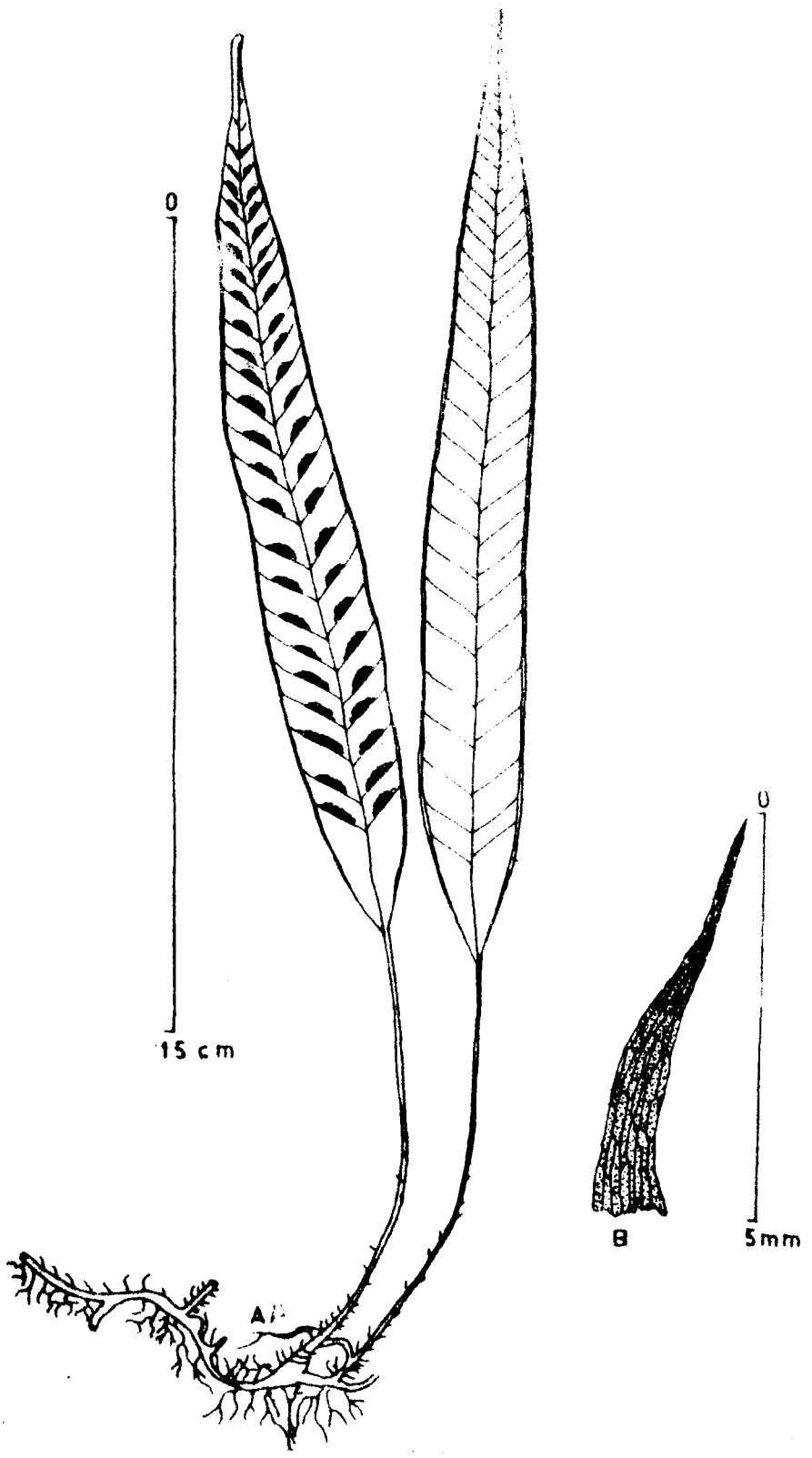


Plate 105: Diplazium subsinuatum (Wall. ex Hook. et Grev.)Copel.
A - Habit; B - sporangium; C - rhizome scale.

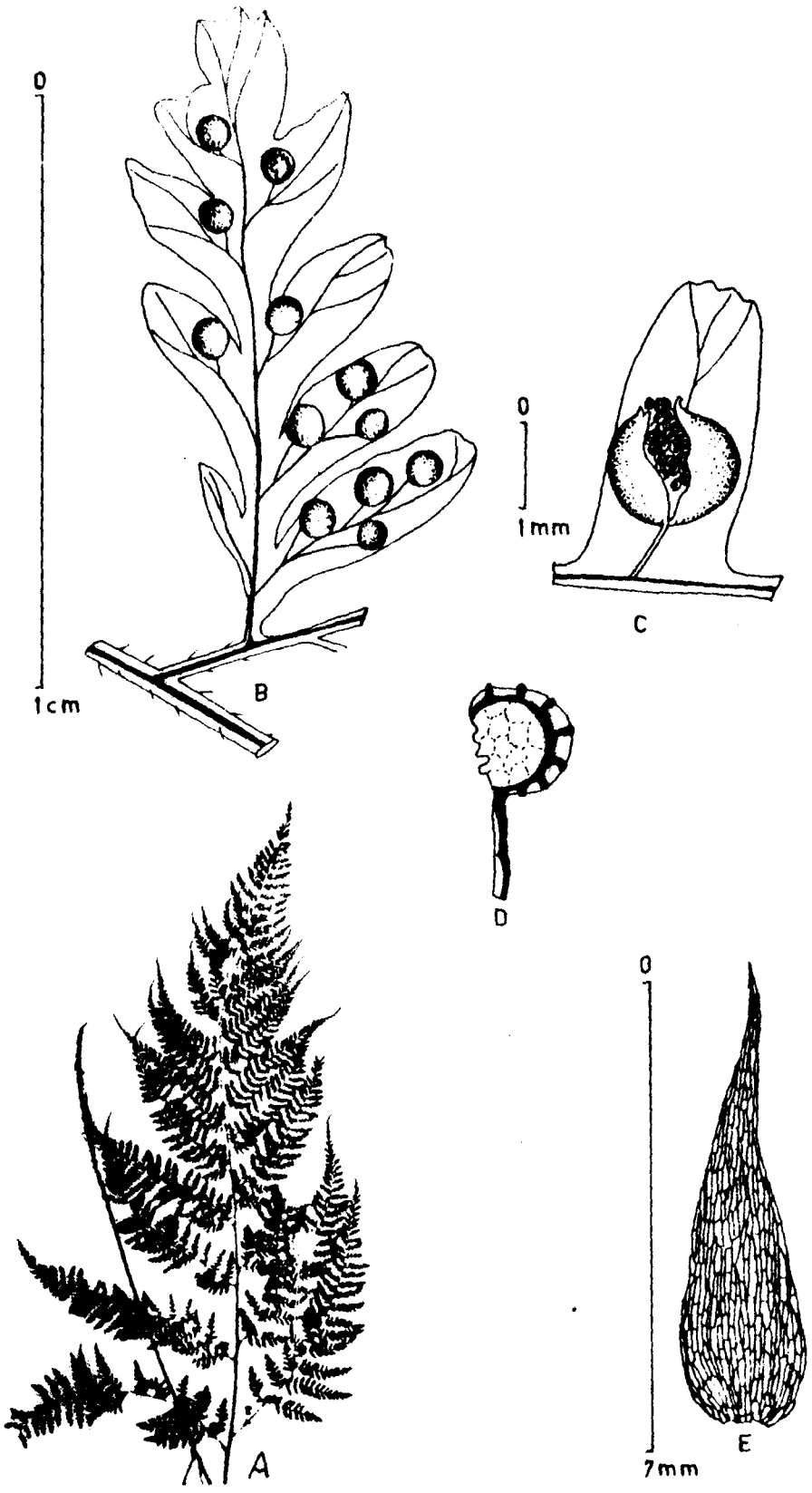


Plate 106: Dicalux aquidioides Blume A - Habit; B - fertile pinnule with venation; C - sorus; D - sporangium; E - rhizome scale.

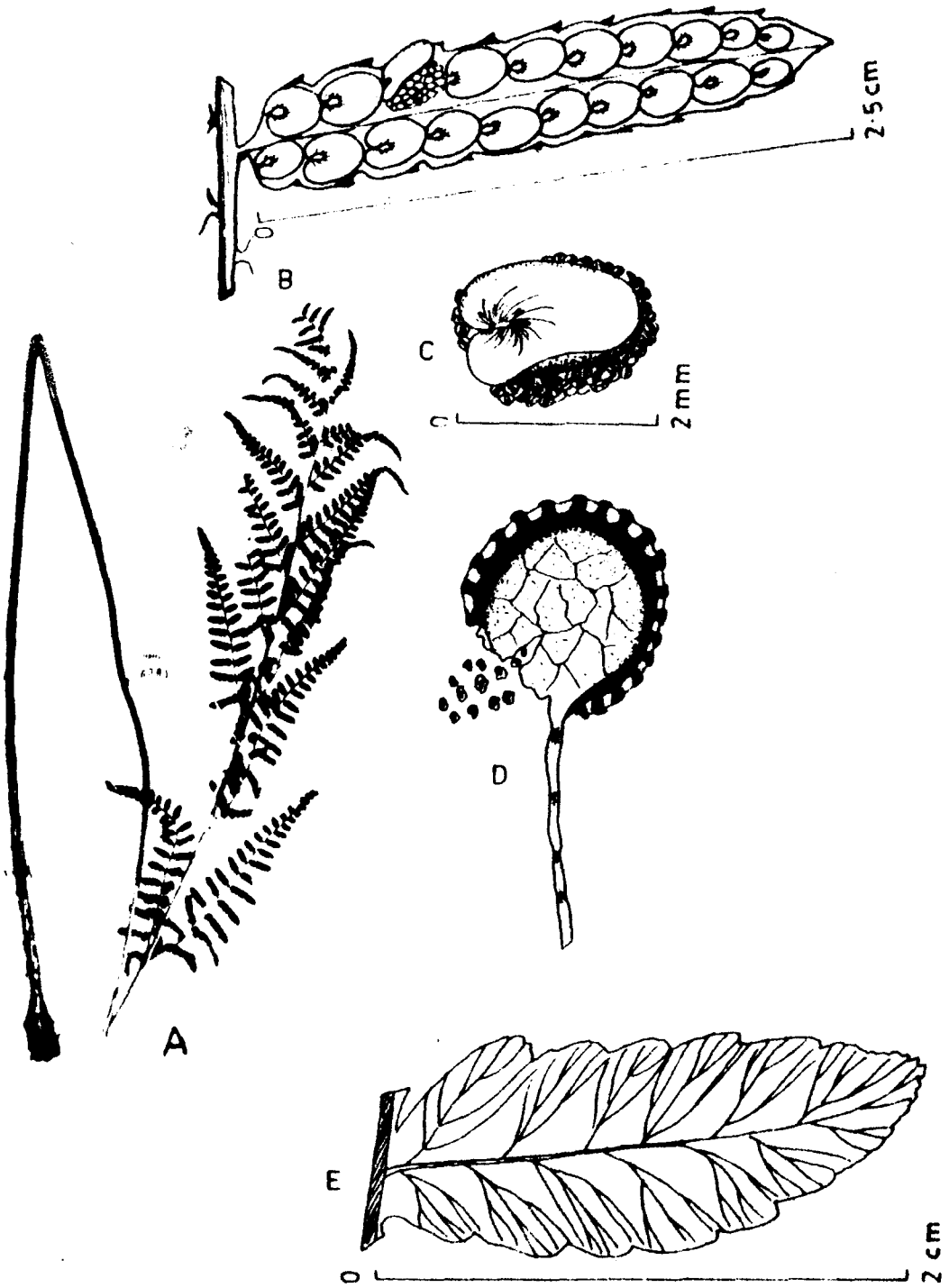


Plate 107: Dryopteris cochleata (D.Don) C.Chr. A - Habit; B - fertile pinna; C - sorus with indusium; D - sporangium; E - sterile pinnule.

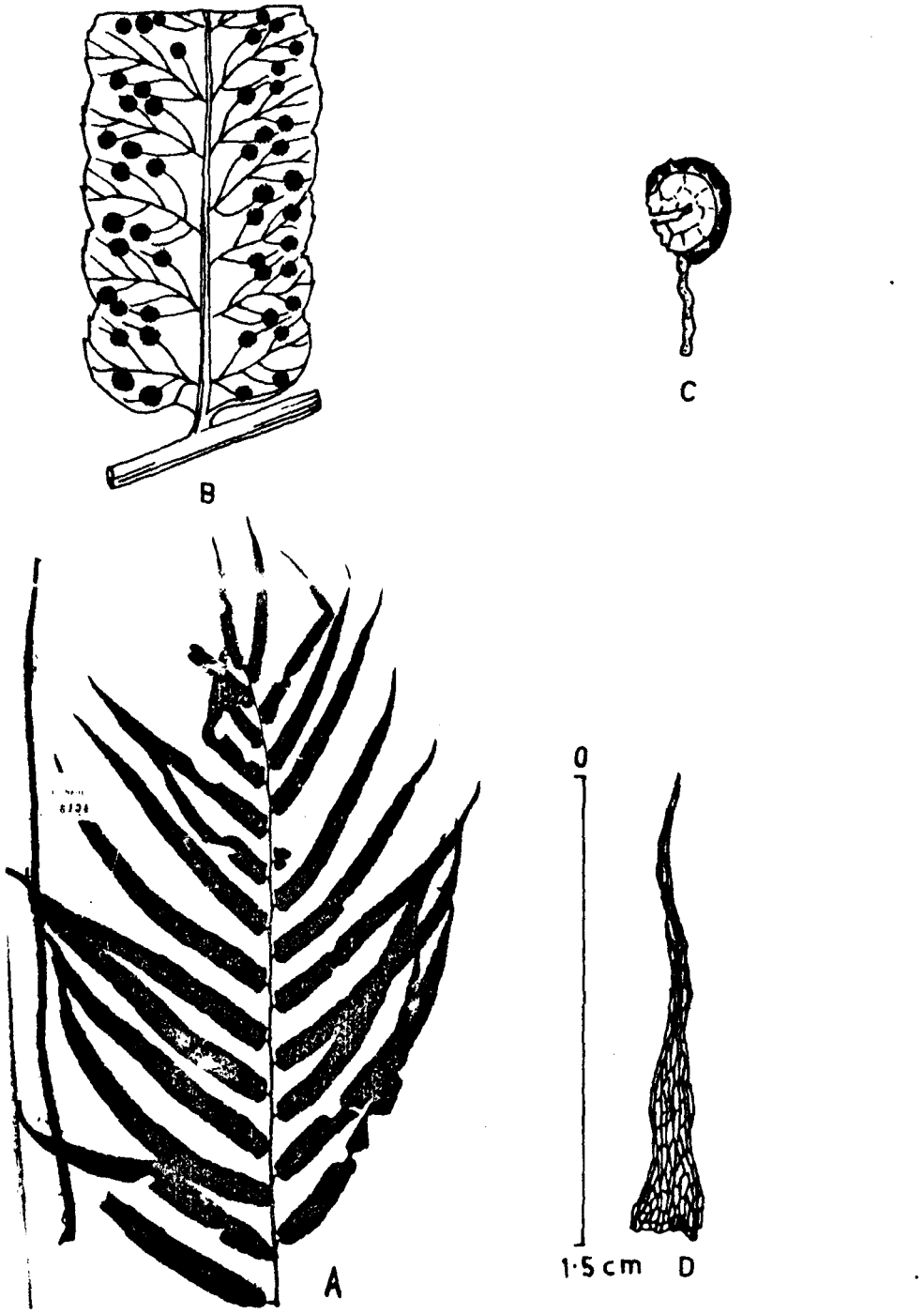


Plate 108: Dryopteris khasyana (Clarke) C.Chr. A - Habit; B - fertile pinna with venation; C - sporangium; D - rhizome scale.

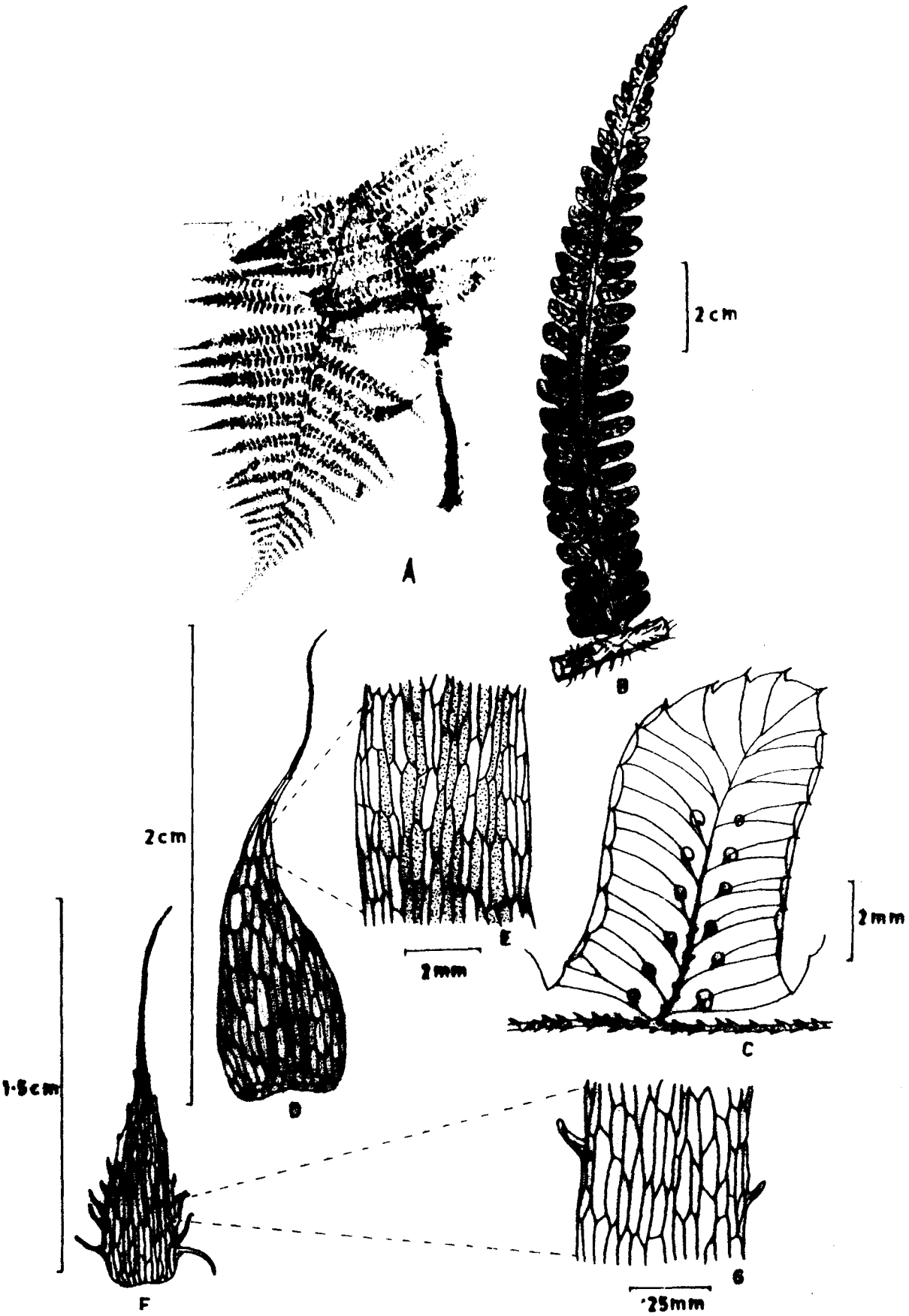


Plate 109: Dryopteris palacea(Moore) Fomin A - Habit; B - pinnae; C - pinnule enlarged; D - rhizome scale; E - portion of rhizome scale enlarged; F - stipe and rachis scale; G - portion of stipe scale enlarged.

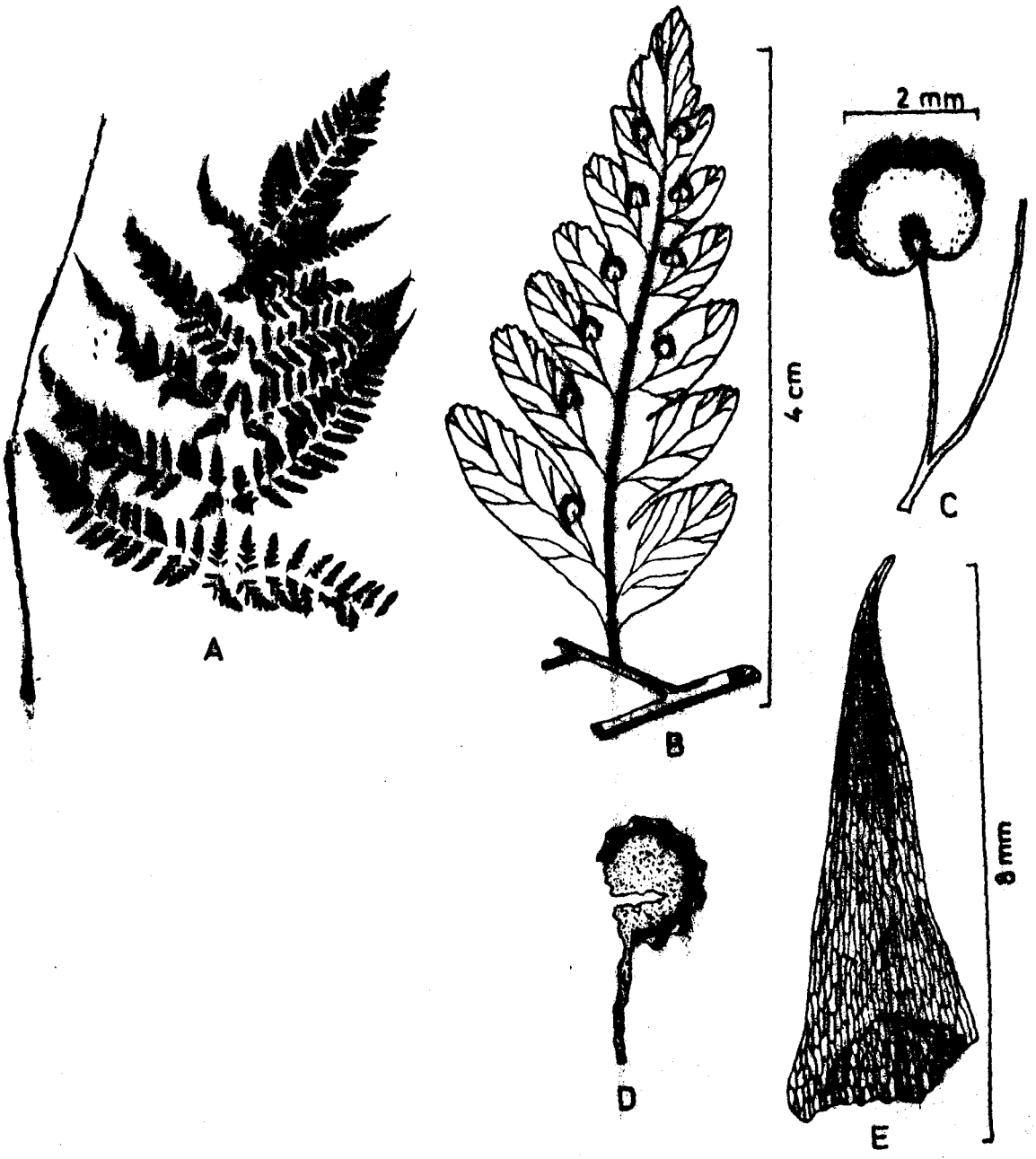


Plate 110: Pryopteris sparsa (D.Don) Kuntze A - Habit; B - fertile pinna; C - sorus with indusium; D - sporangium; E - stipe scale.

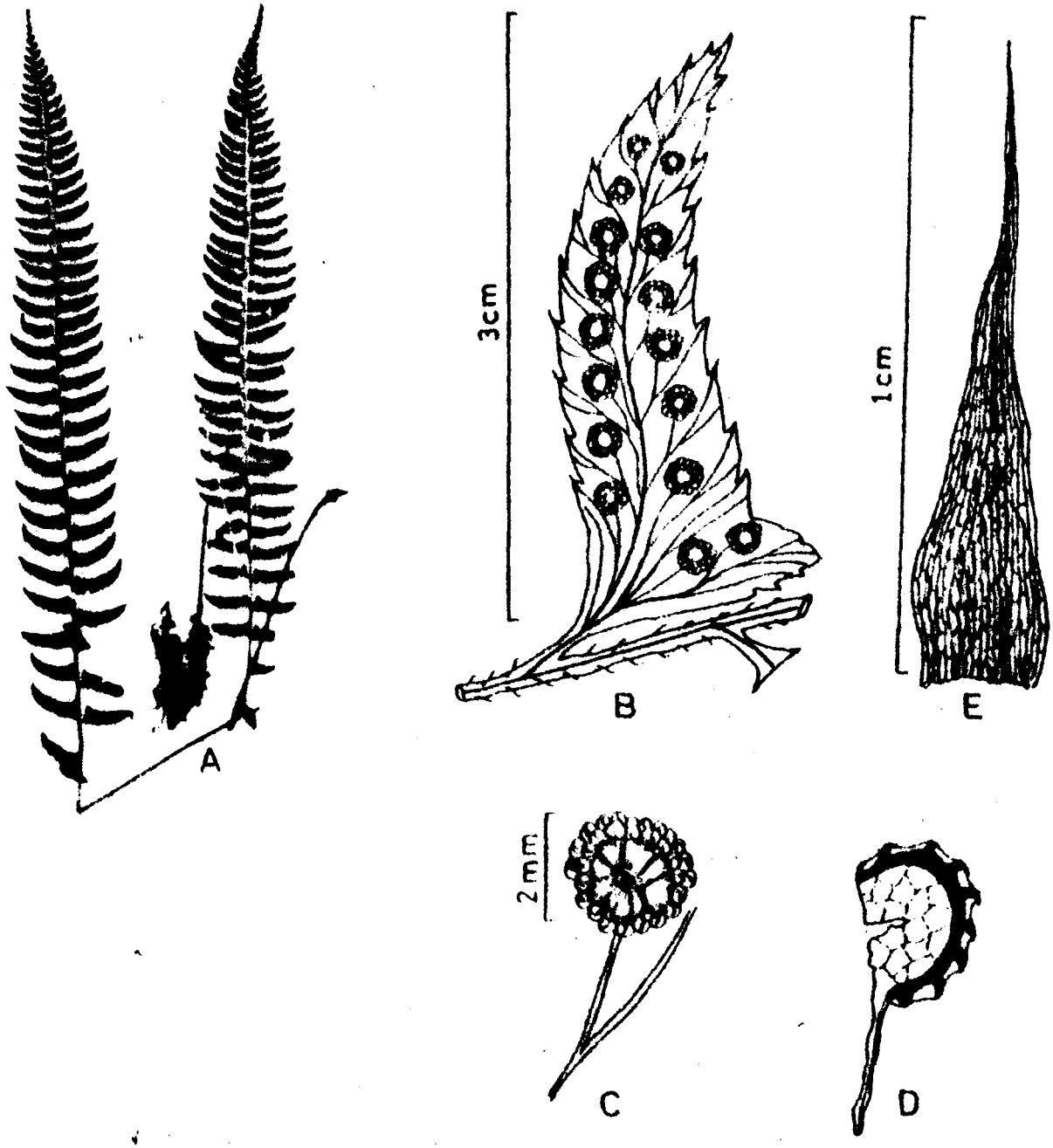


Plate III: Polystichum auriculatum (Linn.) Presl. A - Habit; B- fertile pinna; C - spore with indusium; D - sporangium; E - rhizome scale.

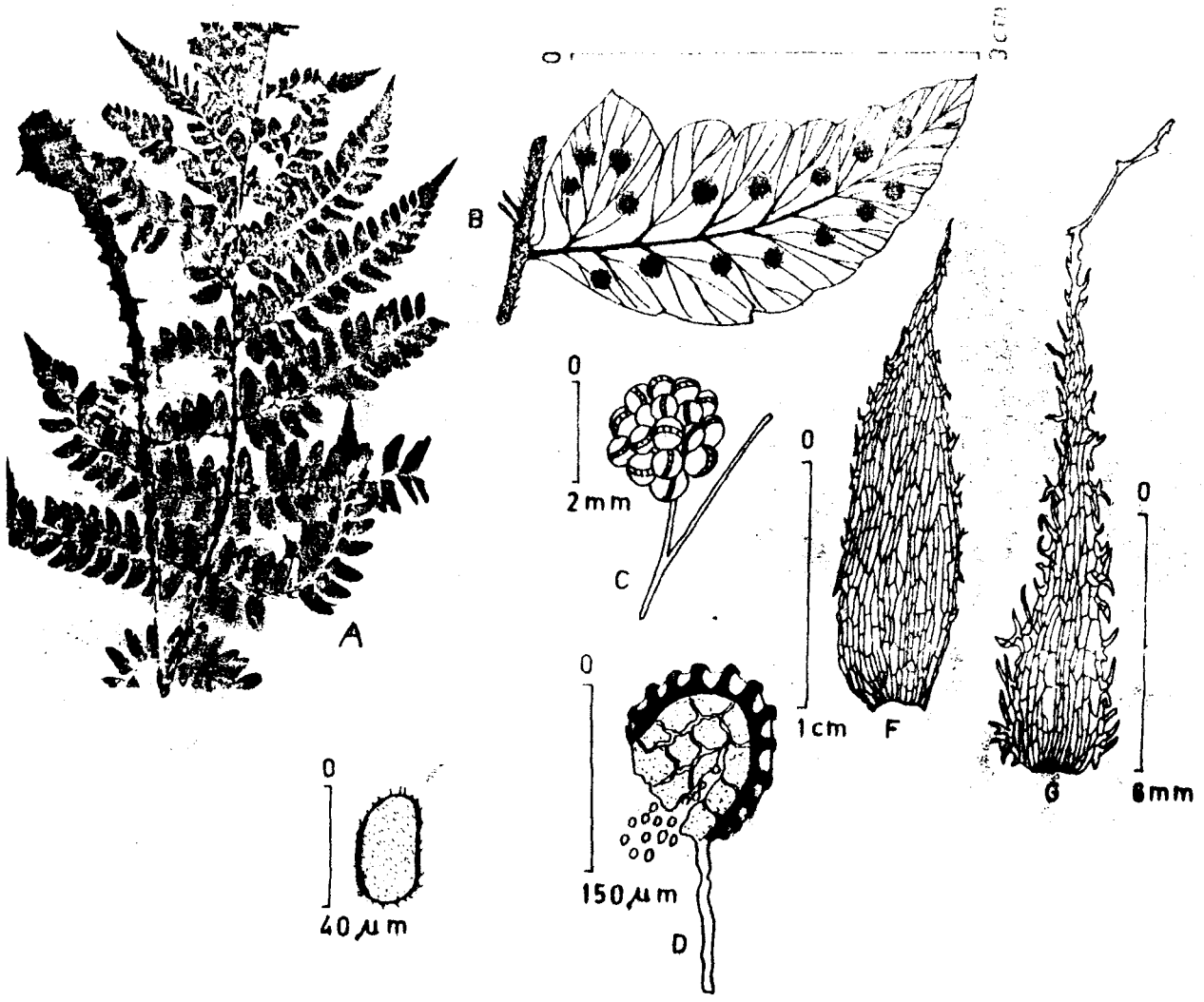


Plate 112: Polystichum birii, sp. nov. A - Habit; B - fertile pinna showing venation and sori; C - sorus; D - sporangium; E - spore; F - stipe scale; G - rachis scale.

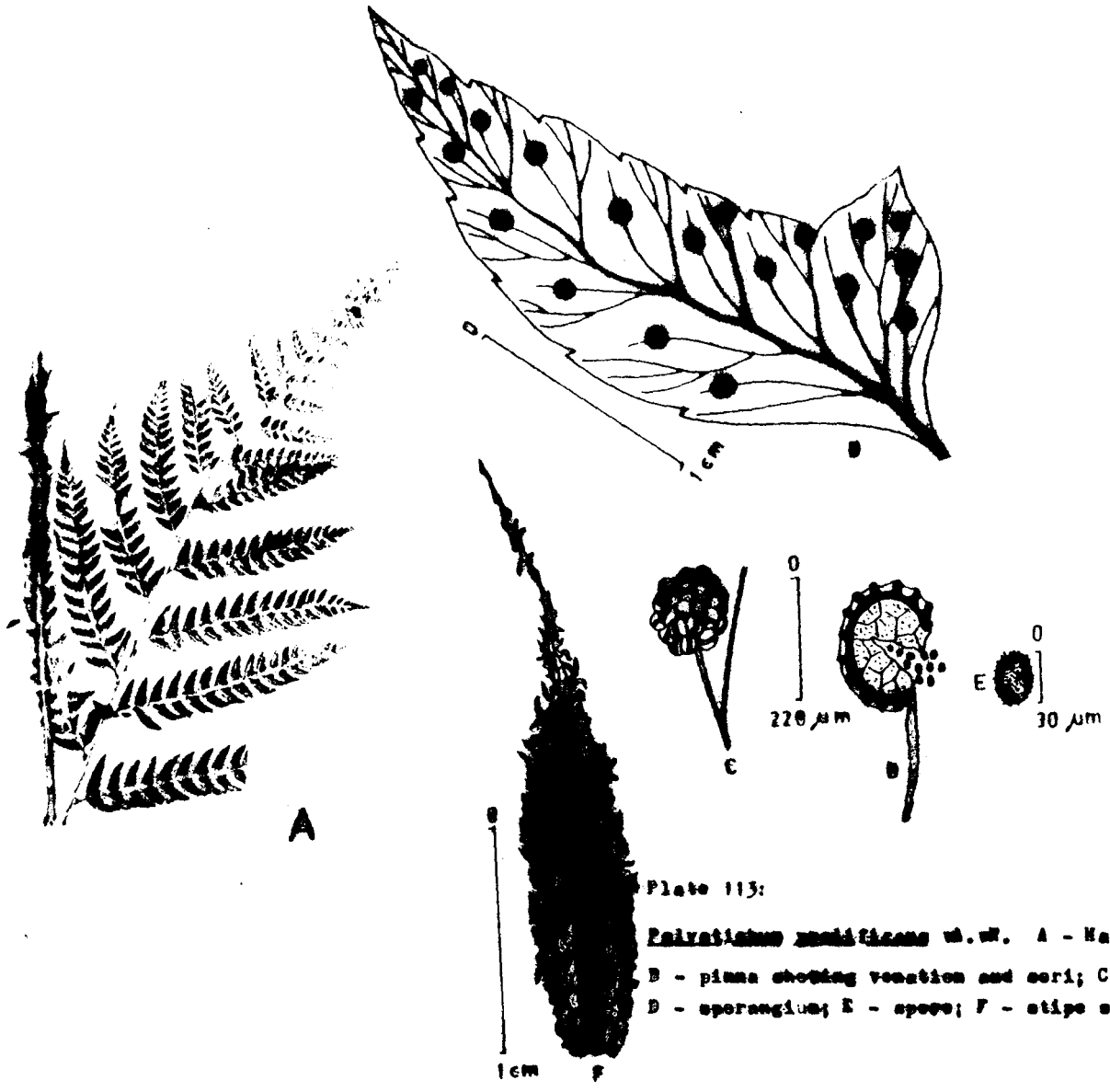


Plate 113:

Polystichum munitissimum Mett. A - Habit;
B - pinna showing venation and sori; C - sorus;
D - sporangium; E - spore; F - stipe scale.

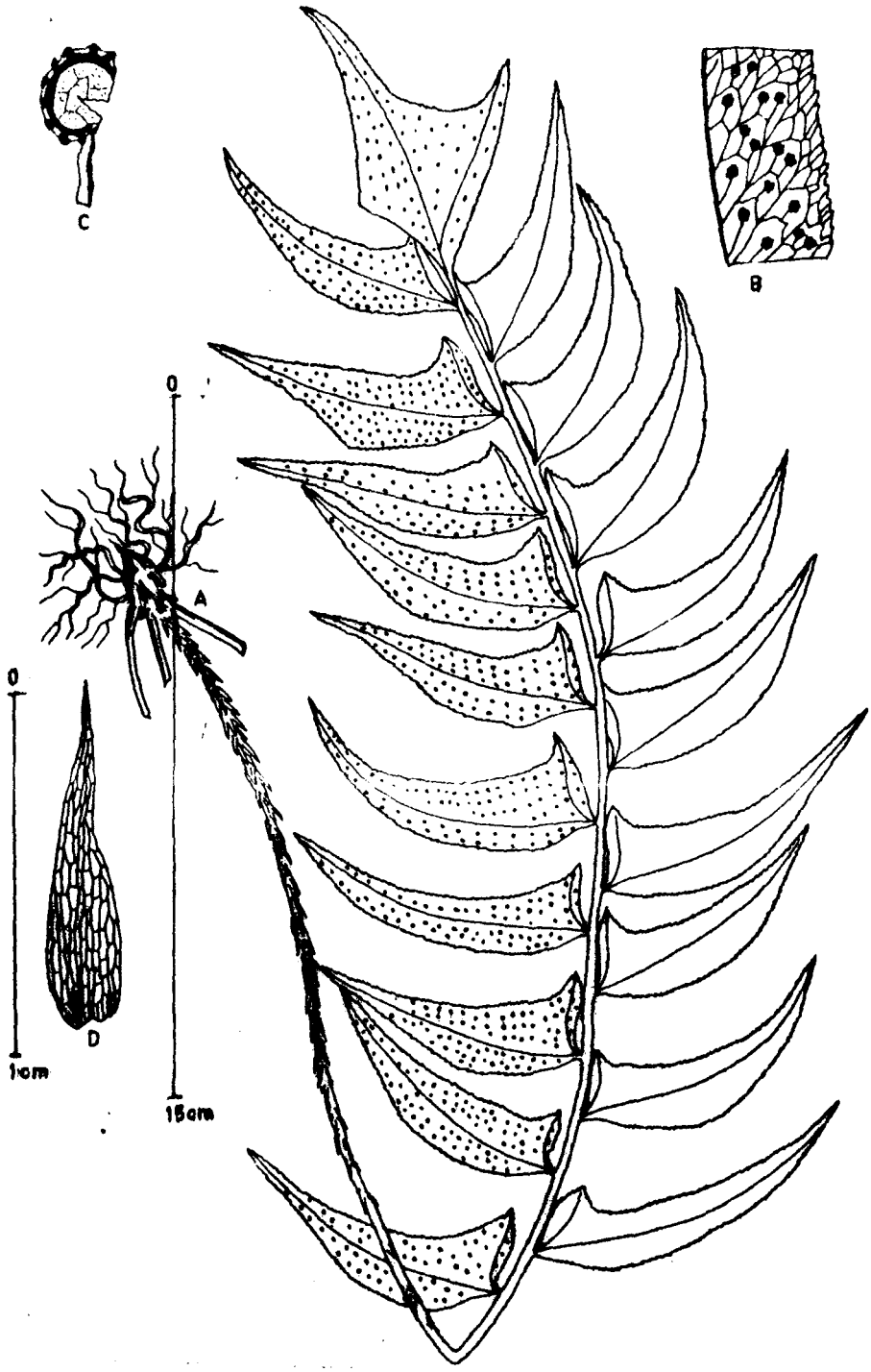


Plate 115: Cyrtomium caryotideum (Wall.) Presl. A - Habit; venation & sori; C - sporangium; D -stipe scale.

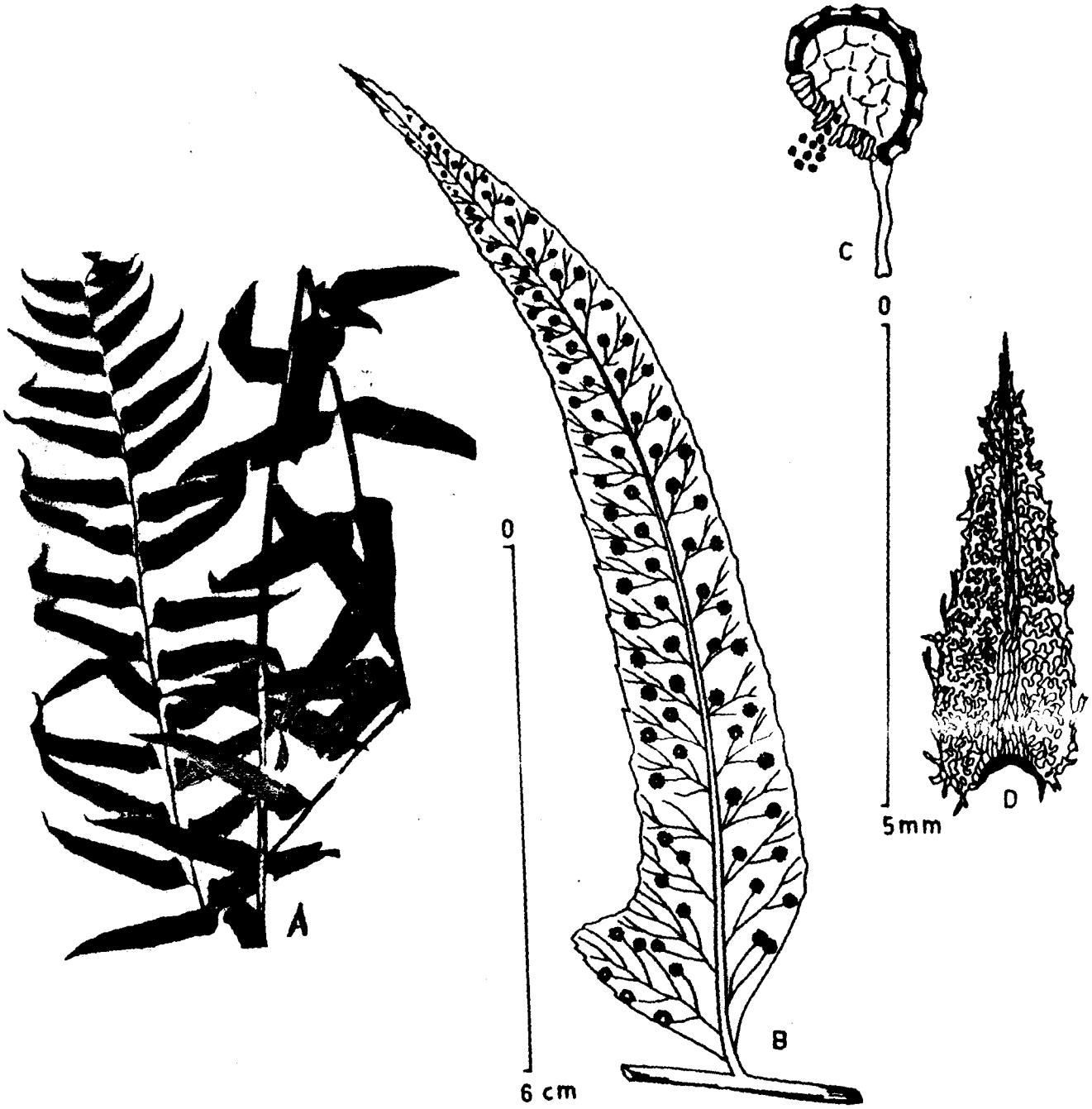


Plate 116: Cyrtomium hookerianum (Presl.) C.Chr. A - Habit; B - pinna; C - portion of pinna; D - stipe scale; E - rhizome scale; F - portion of stipe scale.

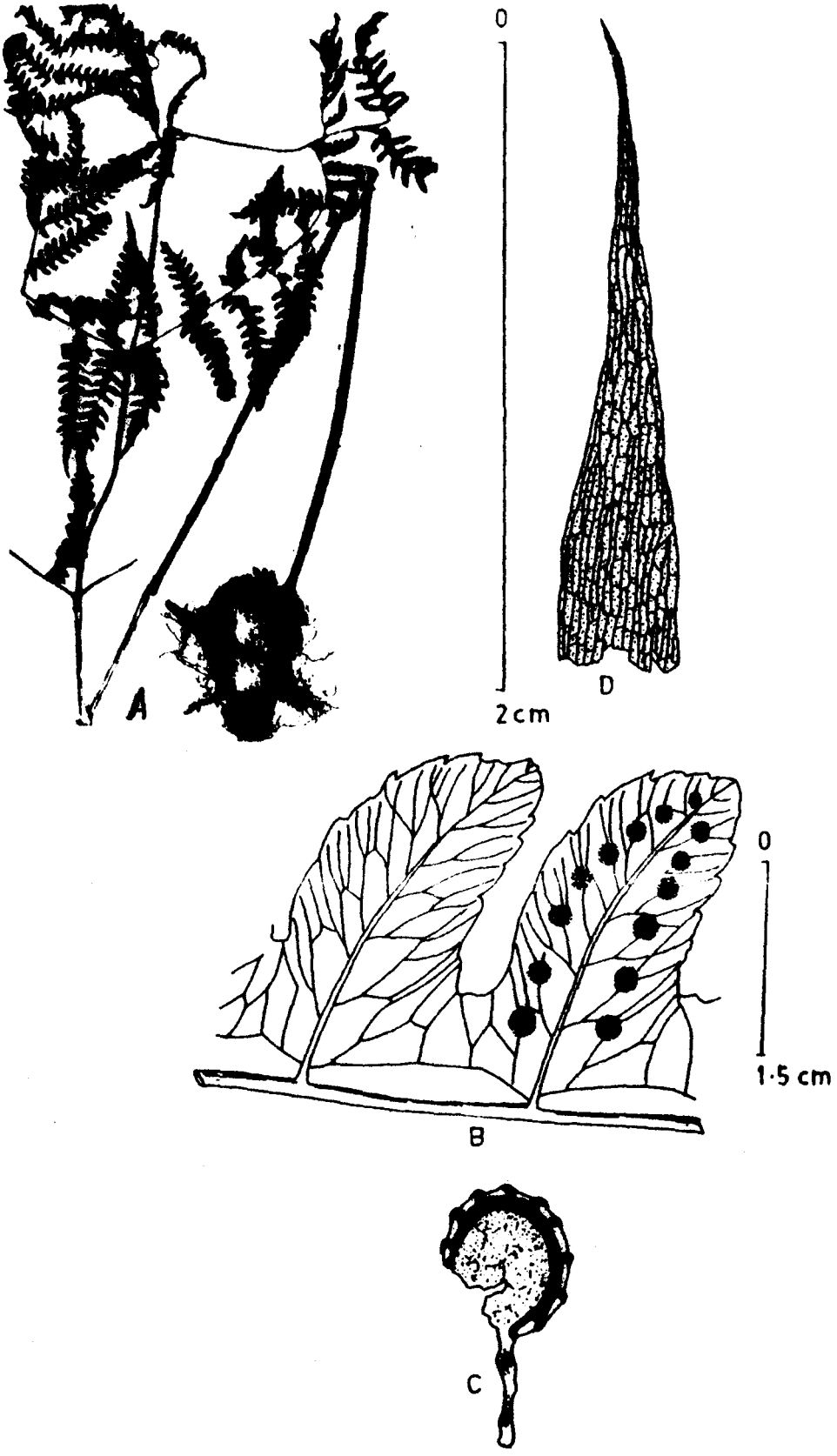


Plate 117: Pleocnemia conjugata (Blume) Presl. A - Habit; B - pinnule showing venation and sori; C - sporangium; D - rhizome scale.

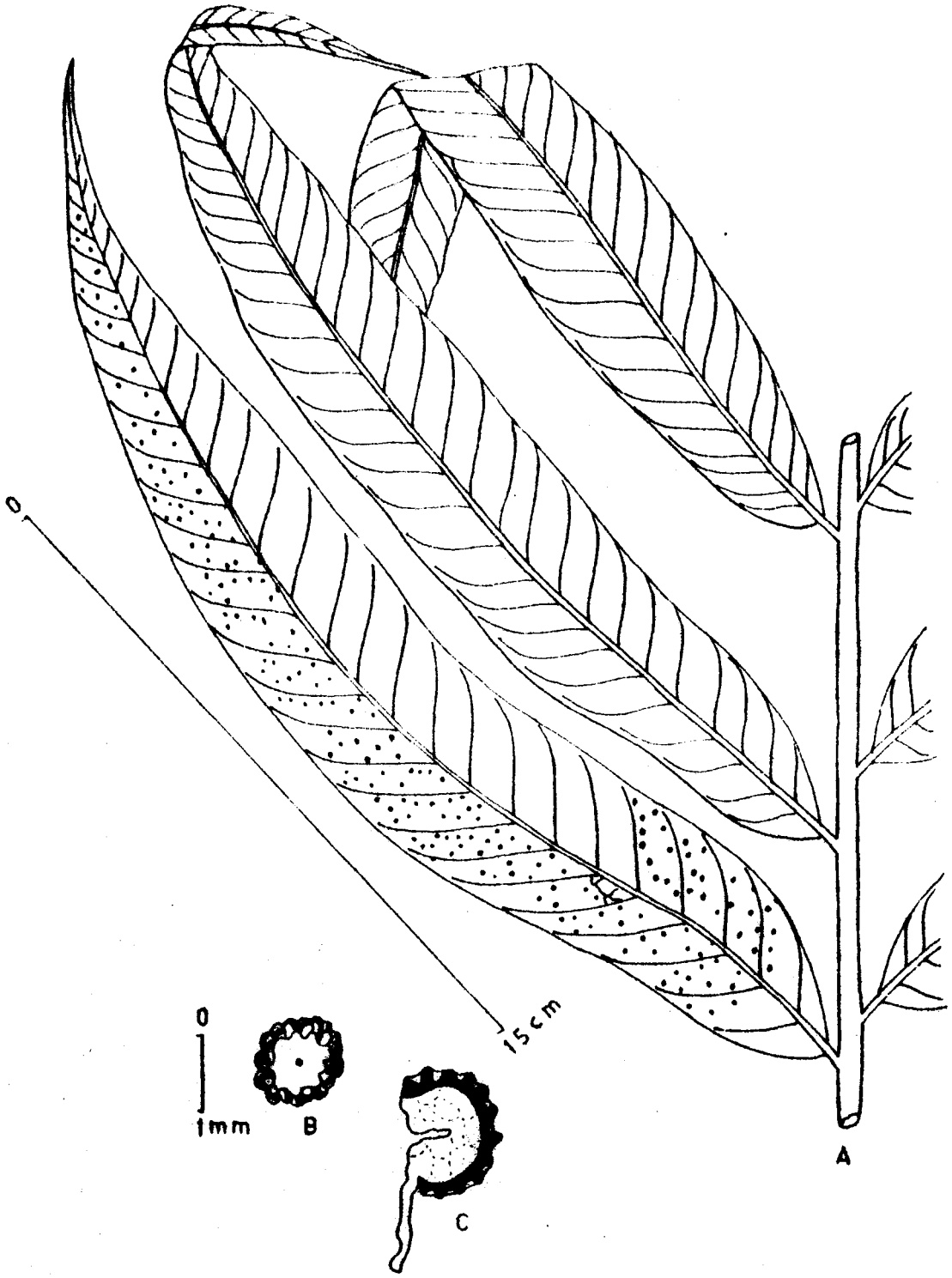


Plate 118: Tectaria heterocarpa (Baker) Ching A - Habit; B - sorus; C - sporangium.

Plate 119: Tectaria macrodonta (Fee) C.Chr. A - Habit; B - sori and venation; C - sporangium; D - rhizome scale.

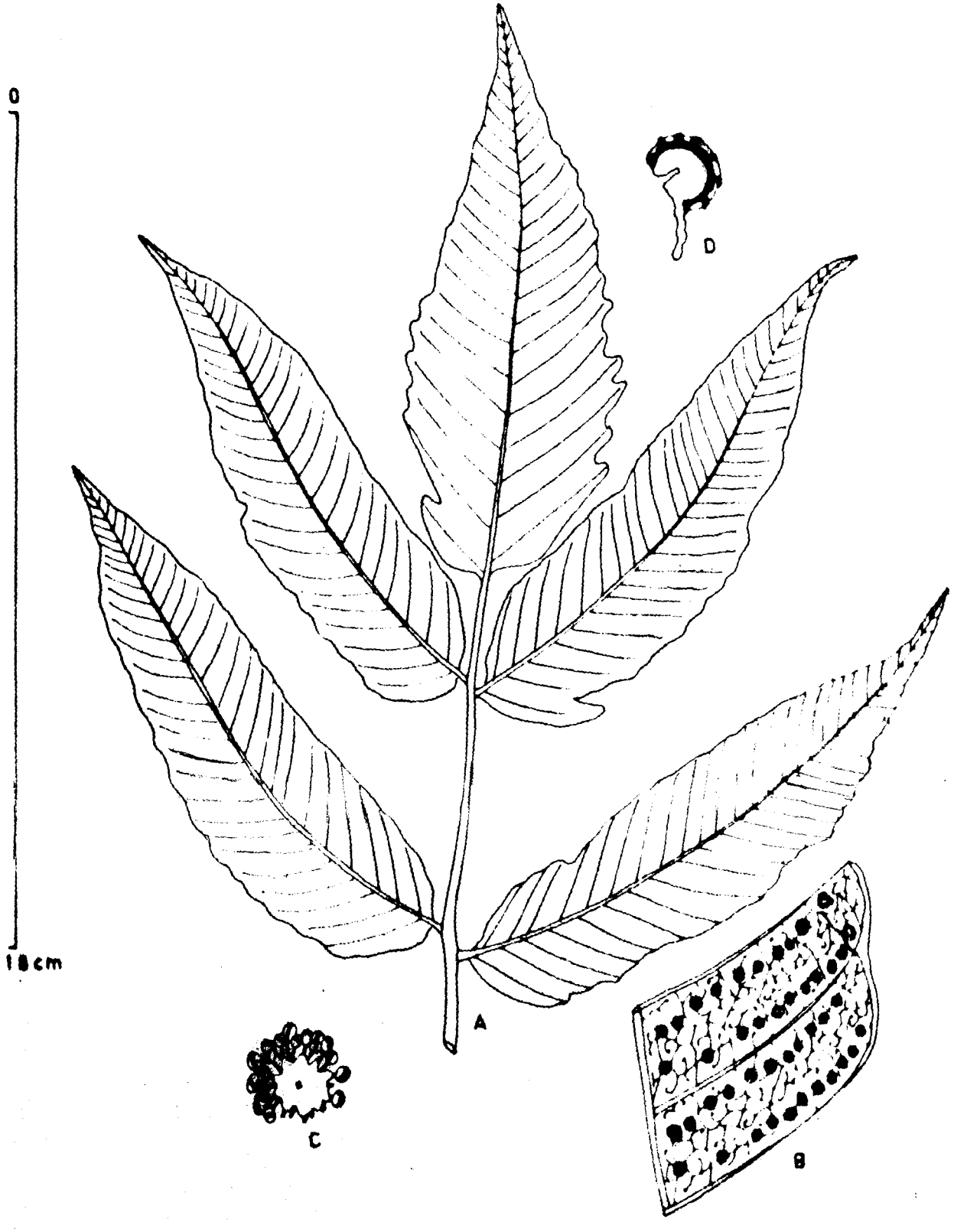


Plate 120: Tectaria polymorpha (Wall. ex Hook.) Copel.
A - Habit (portion); B - portion of pinna showing venation and sori; C - sorus; D - sporangium.

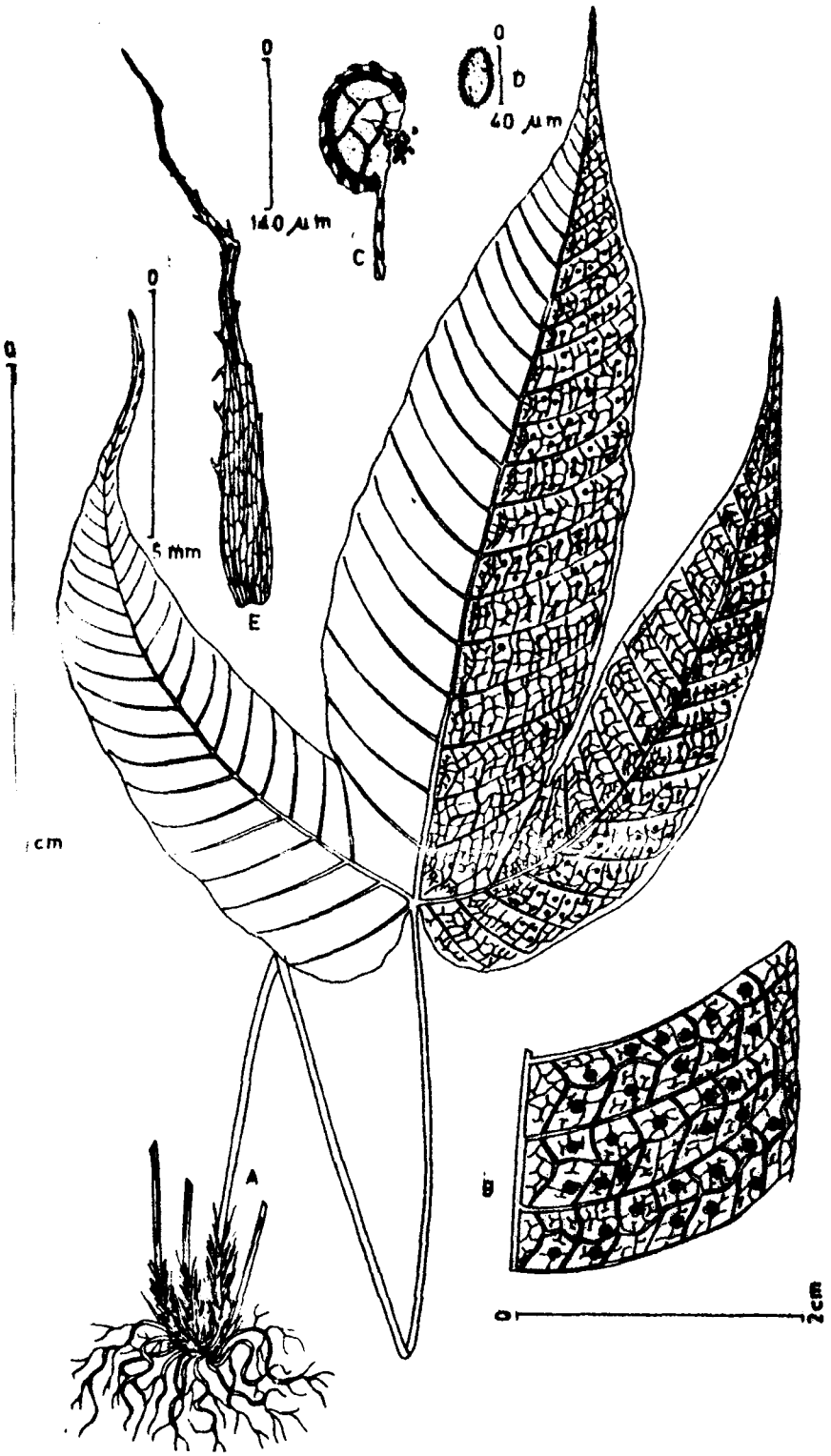


Plate 121: Tacteria polymorpha var. trifida, var. nov.
A - Habit; B - a portion of lamina with venation and sori; C - sporangium; D - spore; E - rhizome scale.

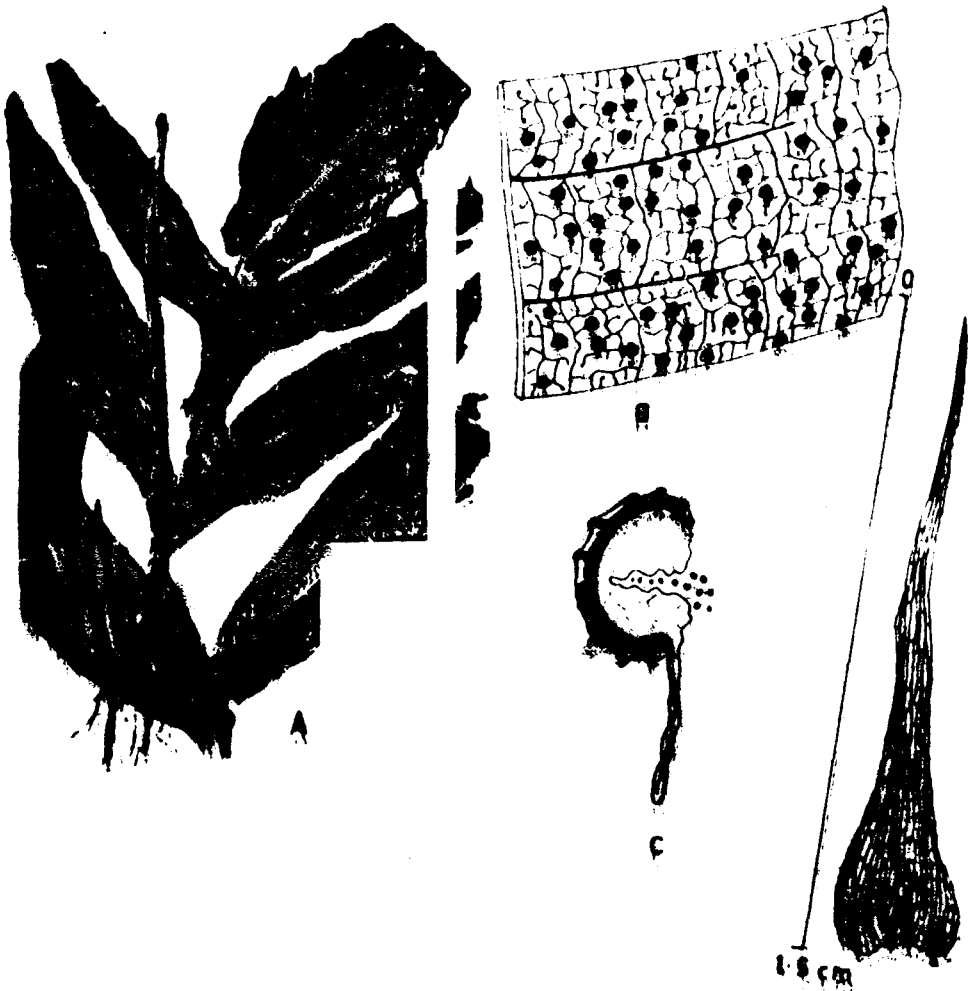


Plate 122: Tectaria wani (Blume) Copel. A - Habit; B - a portion of fertile lamina showing venation; C - sporangium D - stipe scale.

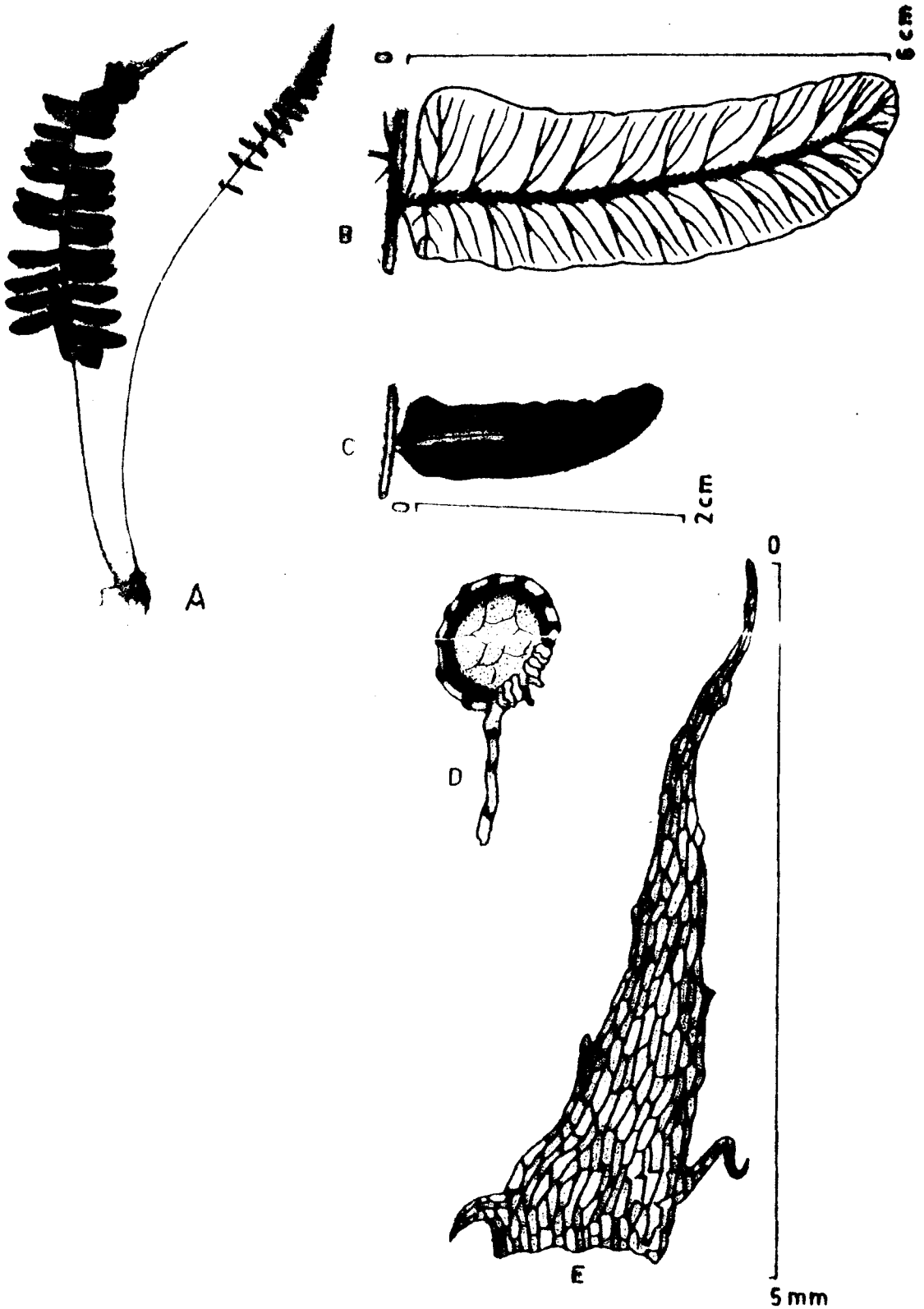


Plate 123: Egenolfia appendiculata (Willd.) J.Smith A - Habit; B - sterile pinna showing venation; C - fertile pinna with sori; D - sporangium; E - stipe scale.

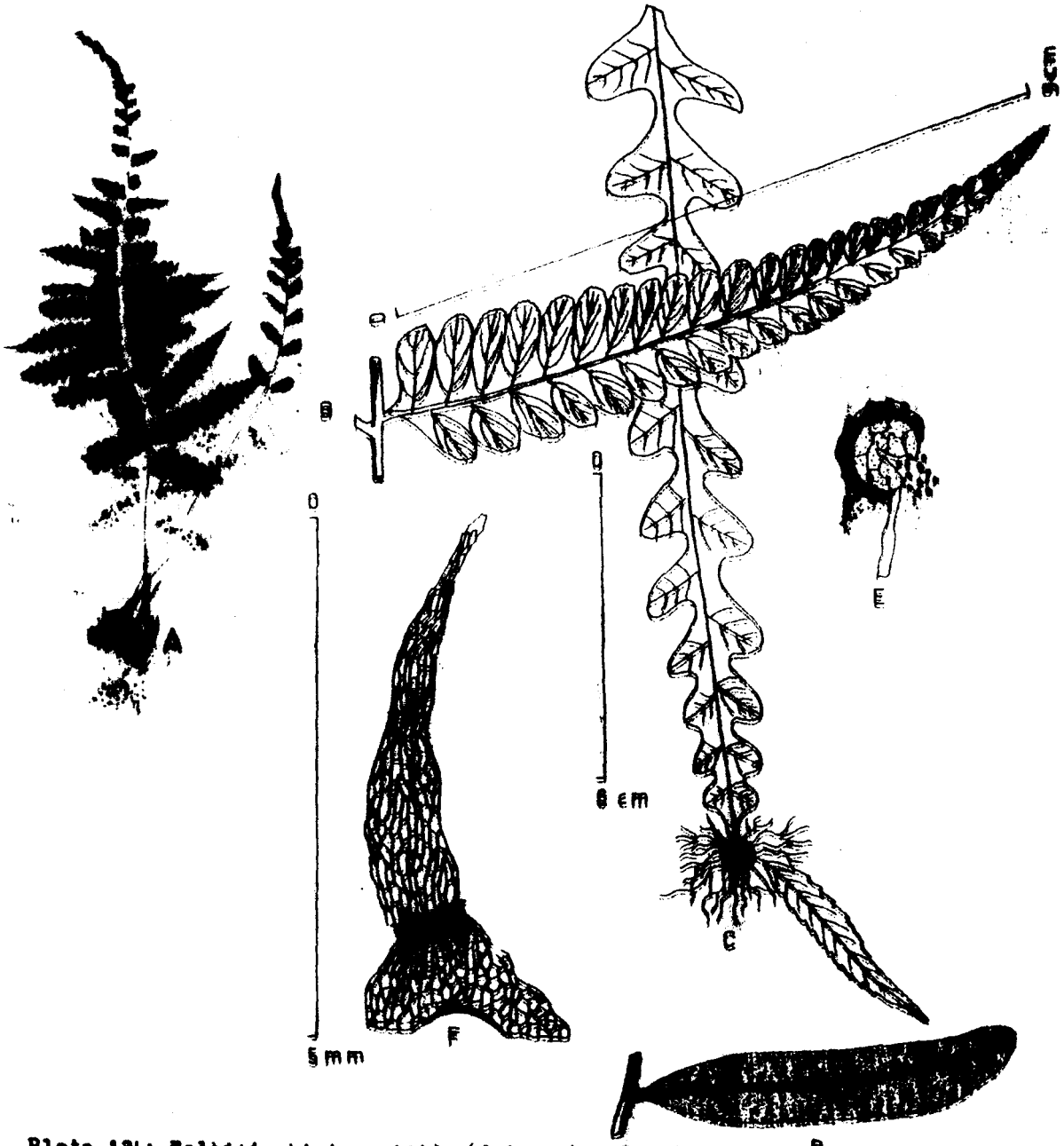


Plate 124: Bolbitis hippocastanifolia (J.Smith) K.Iwats.
A = Habit; B = sterile pinna; C = apical lamina with proliferous buds; D = fertile pinna; E = sporangium; F = rhizome scale.

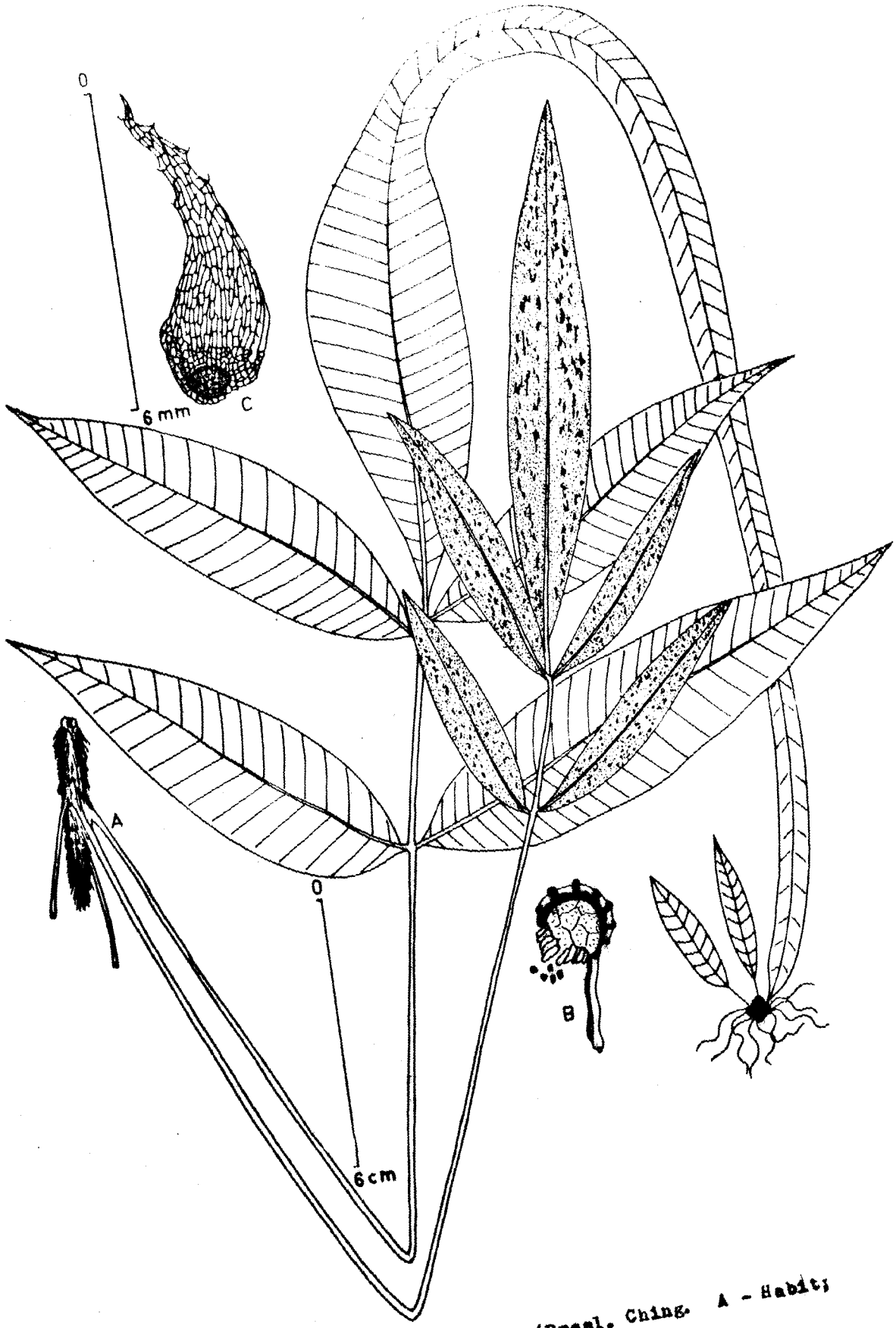


Plate 125: Bolbitis heteroclita (Presl. Ching. A - Habit; B - sporangium; C - rhizome scale.

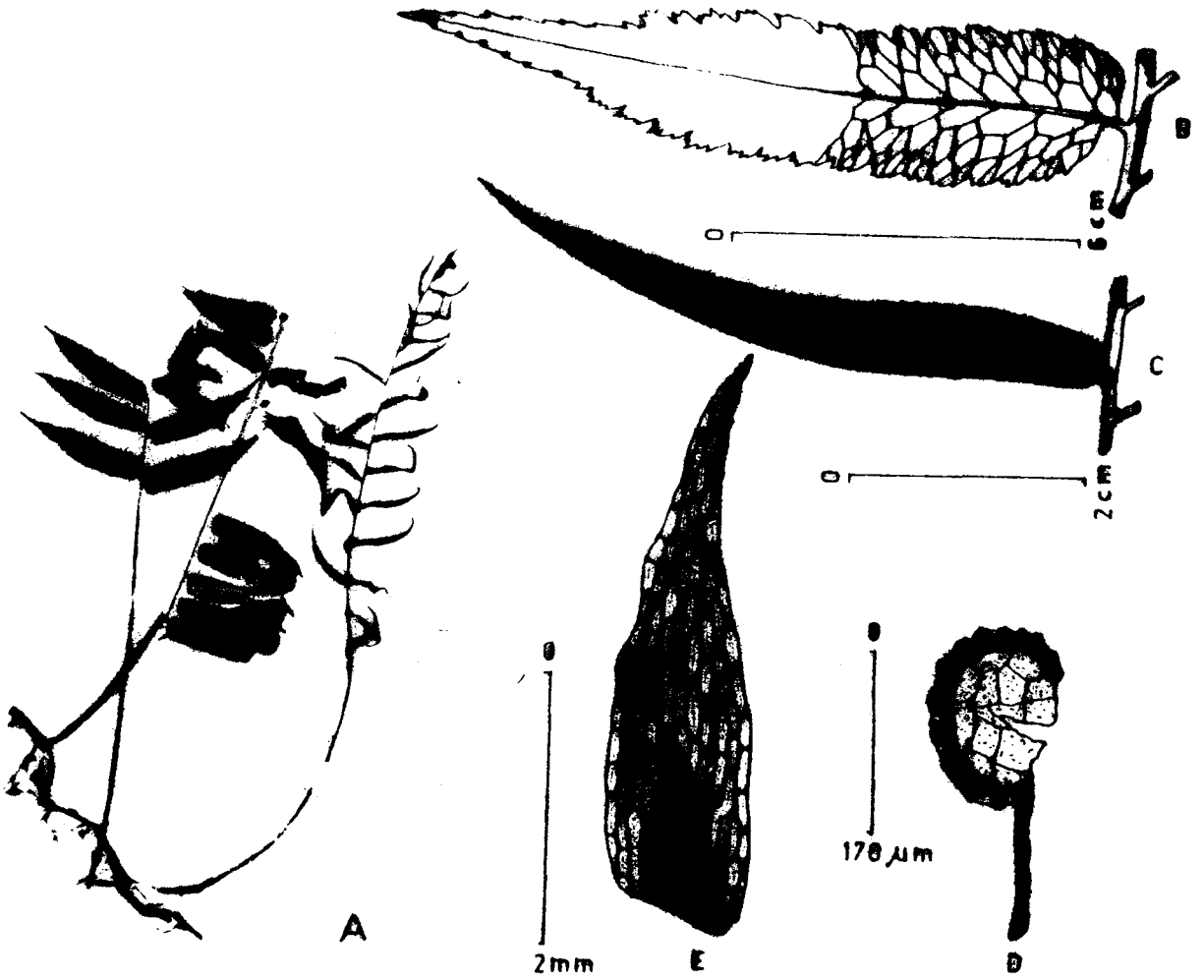


Plate 126: Salbikhinia ramakrishnanii, sp. nov. A - Habit; B - sterile pinna showing venation; C - fertile pinna with sori; D - sporangium; E - stipe scale.

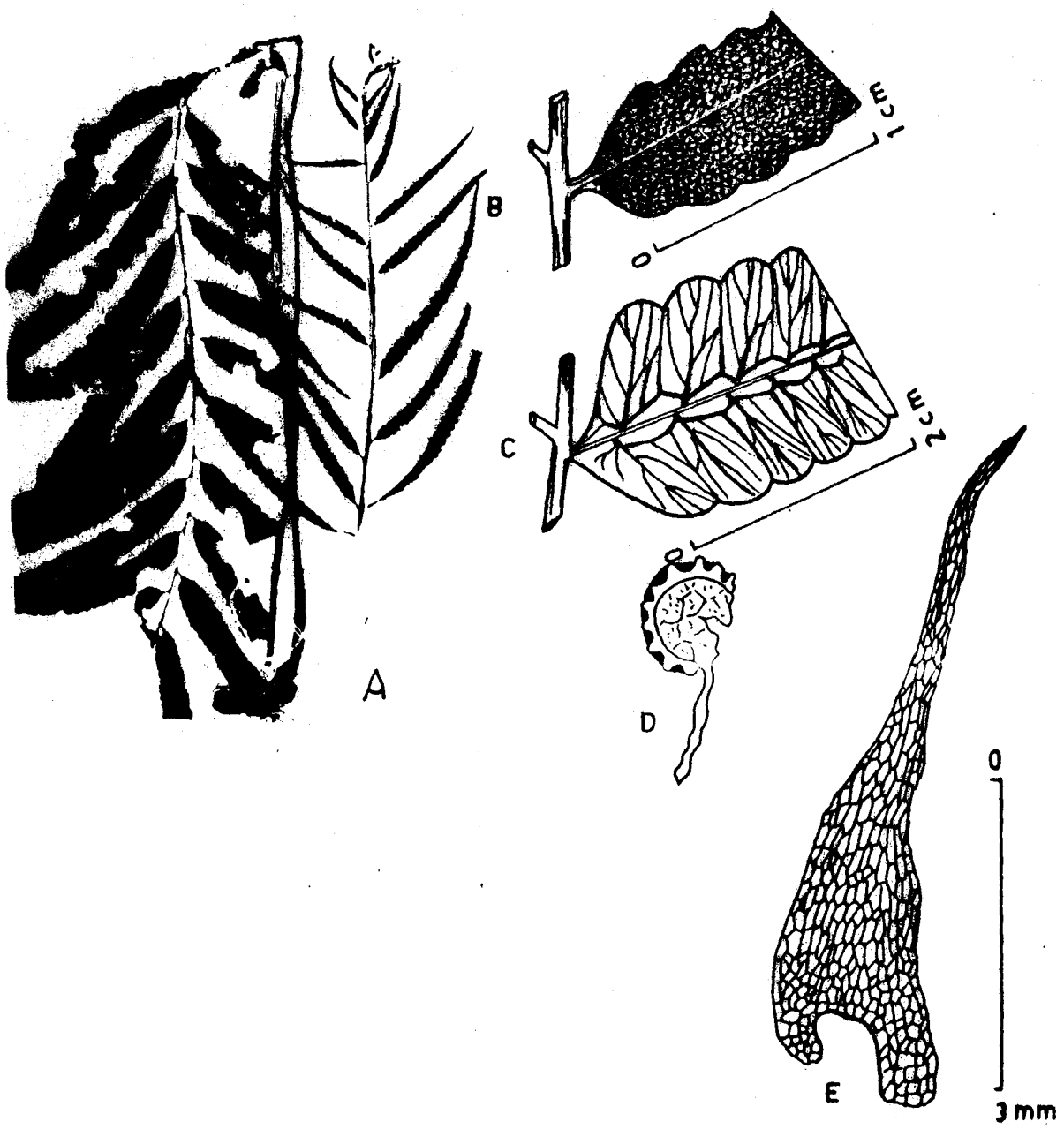


Plate 127: Bolbitis virens (Wall.) Schott A - Habit;
B- fertile pinna;with sori; C - sterile pinna;
D - sporangium; E - stipe scale.

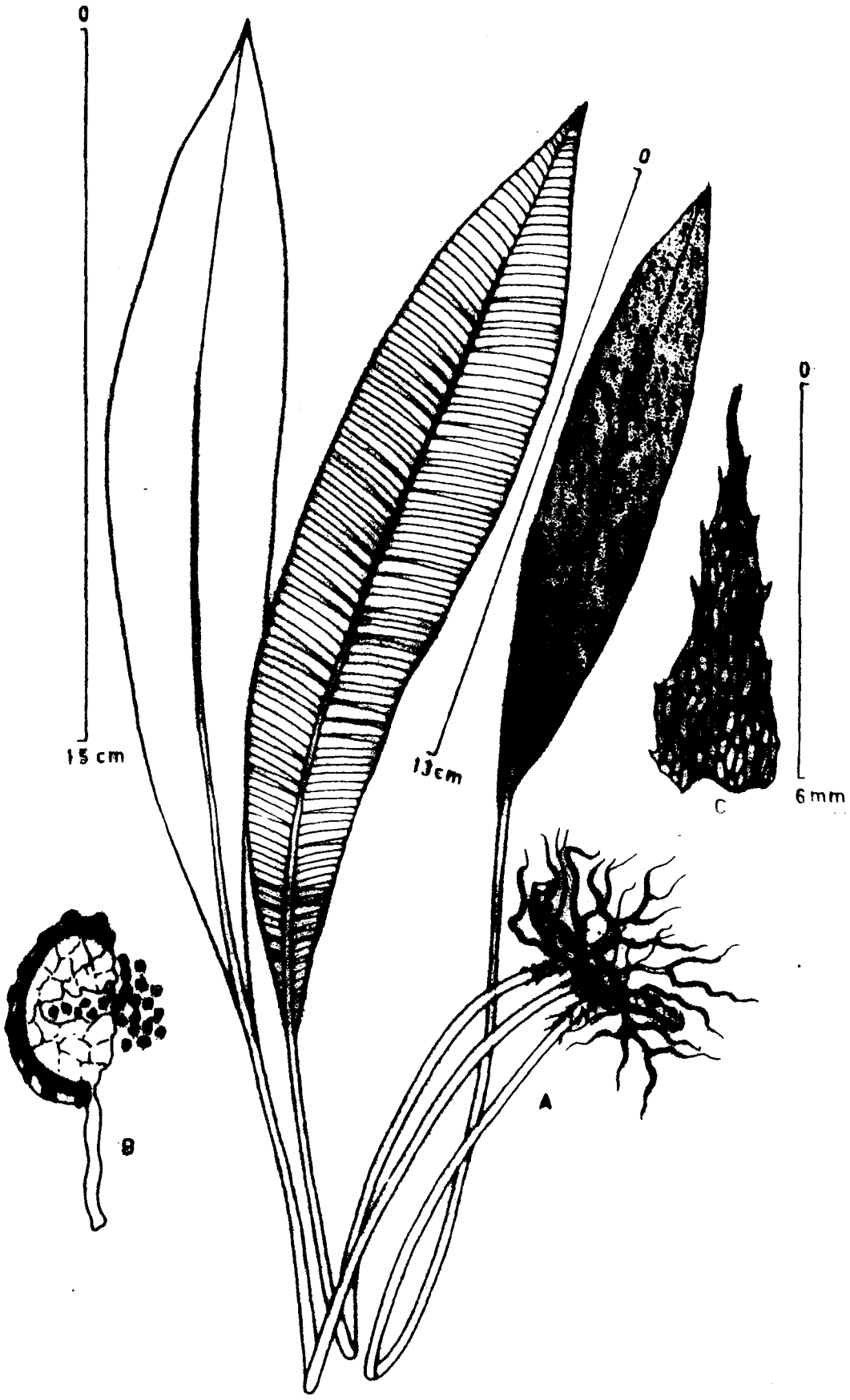


Plate 128: Elaphoglossum yungaense (Baker) C.Chr.
A - Habit; B - sporangium with spores;
D - rhizome scale.

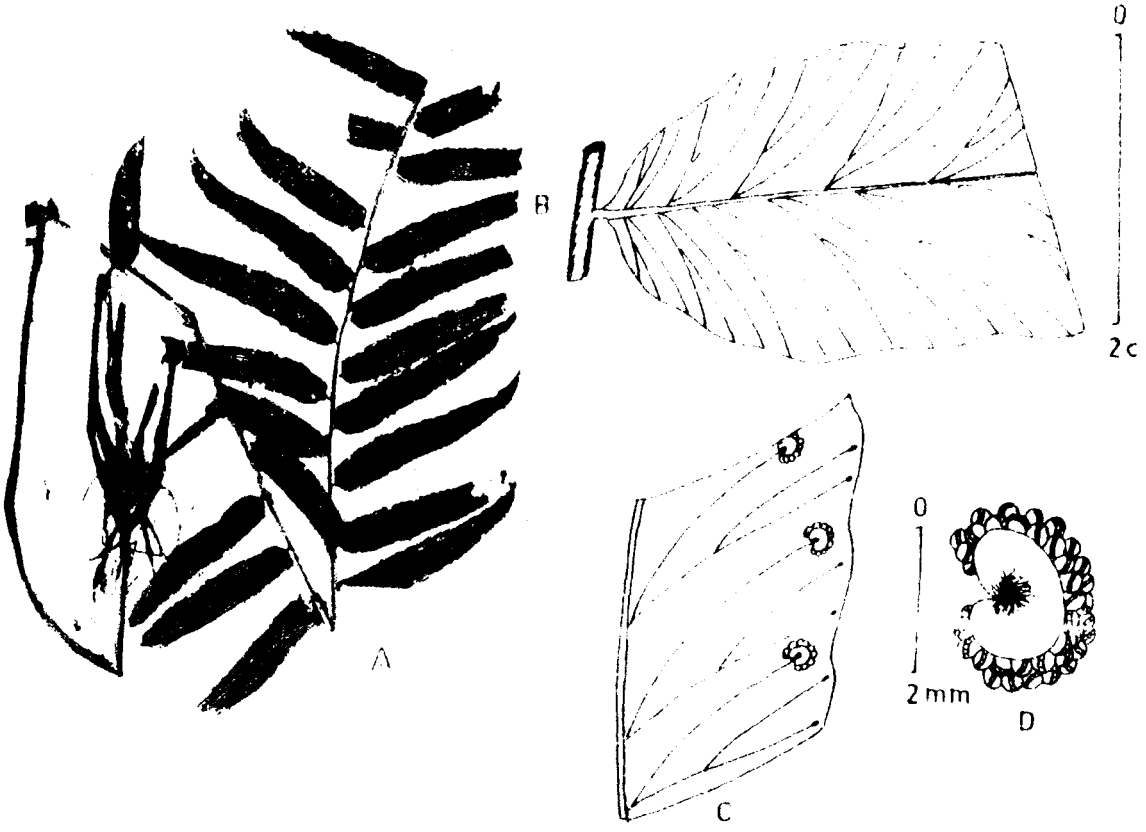


Plate 129: Nephrolepis bisserata (Sw.) Schott. A - Habit;
B - A portion of sterile pinna with venation;
C - A portion of fertile pinna with sori;
D - Sorus; E - Sporangium.

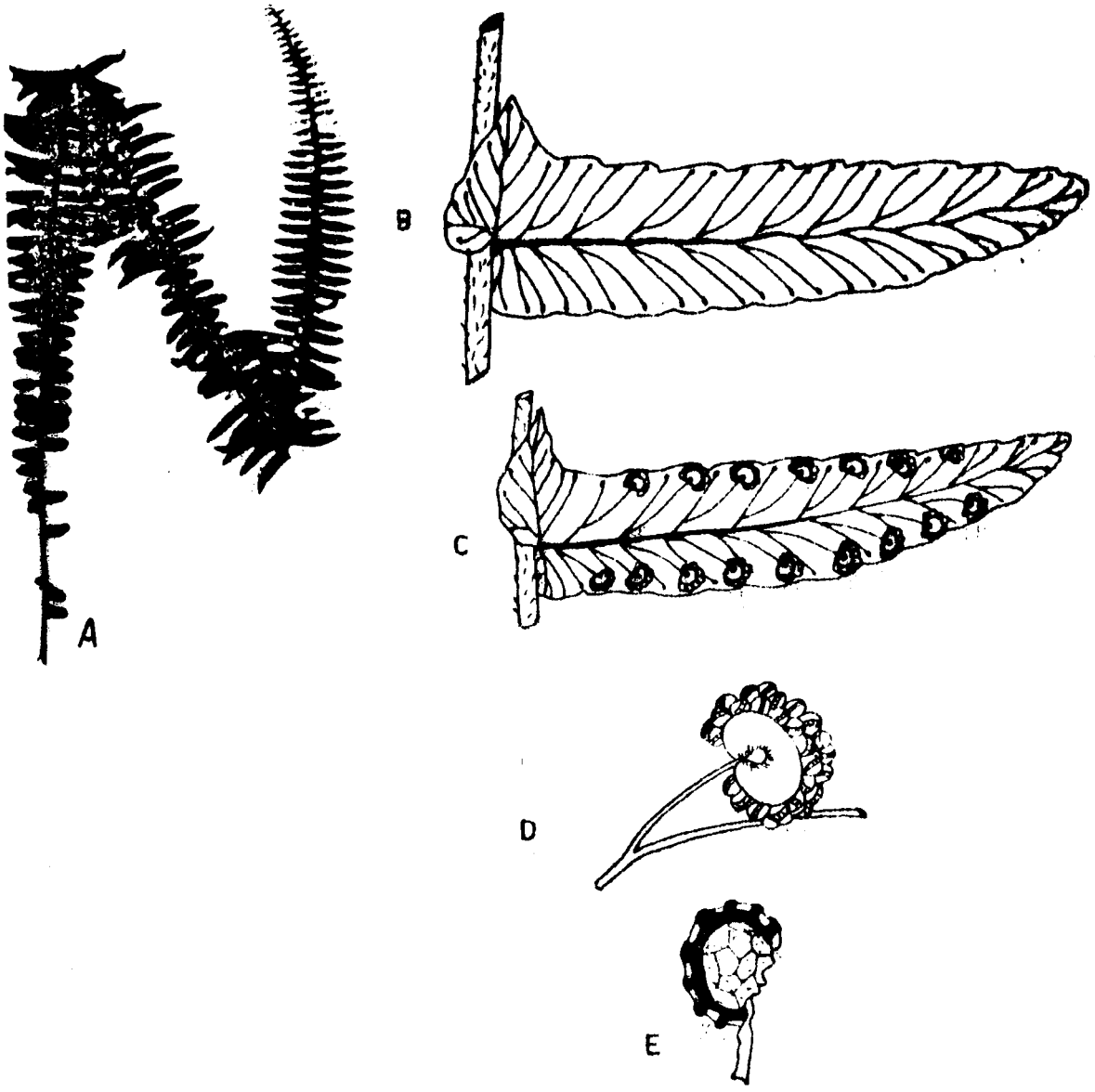


Plate 130: Nephrolepis cordifolia (Linn.) Presl. A - Habit; B - a sterile pinna; C - fertile pinna with sori; D - sorus.

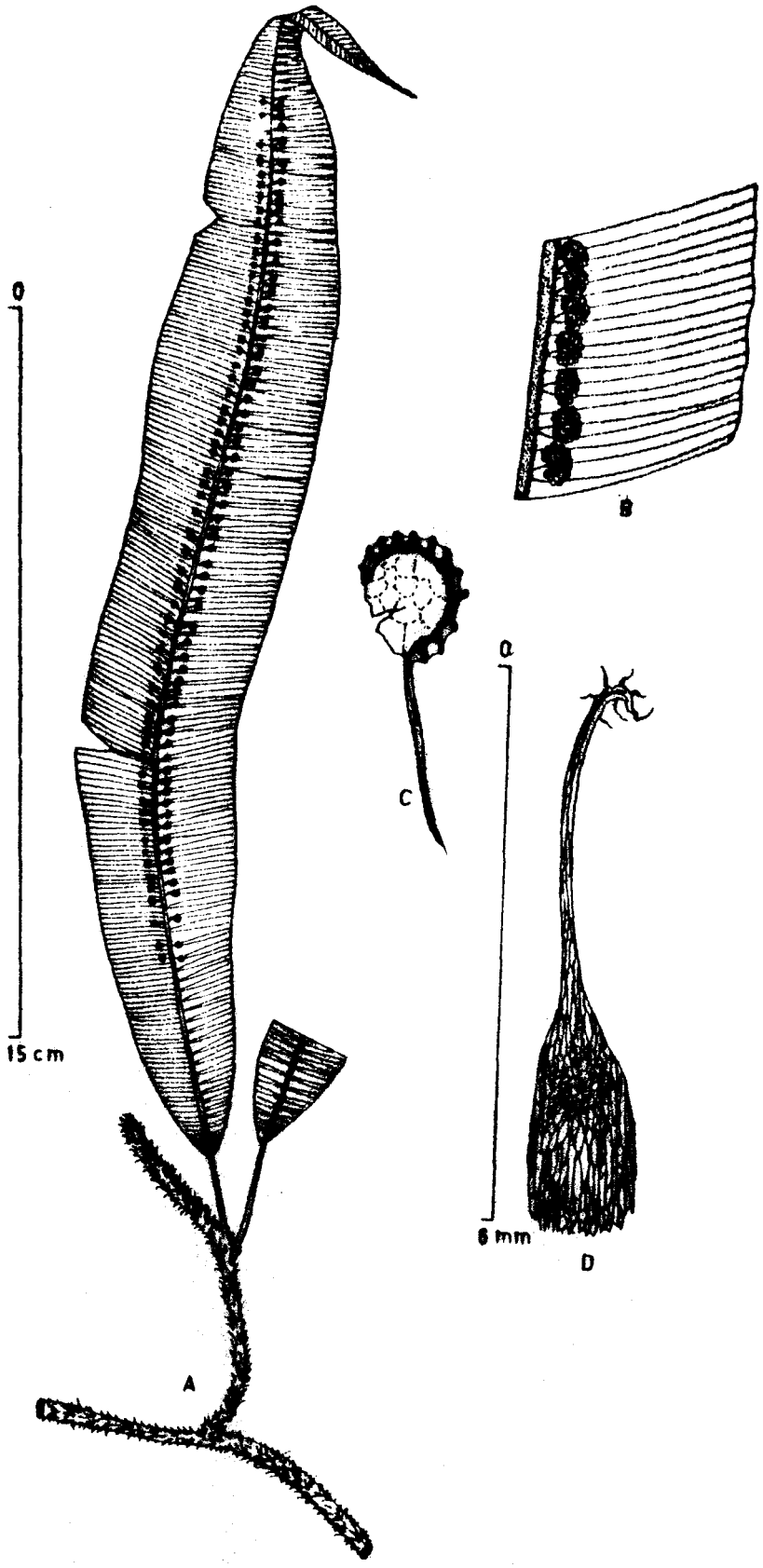


Plate 131: Oleandra wallichii (Hook.) Presl. A - Habit;
B - a portion of fertile frond showing;venation;
C - sporangium; D - rhizome scale.

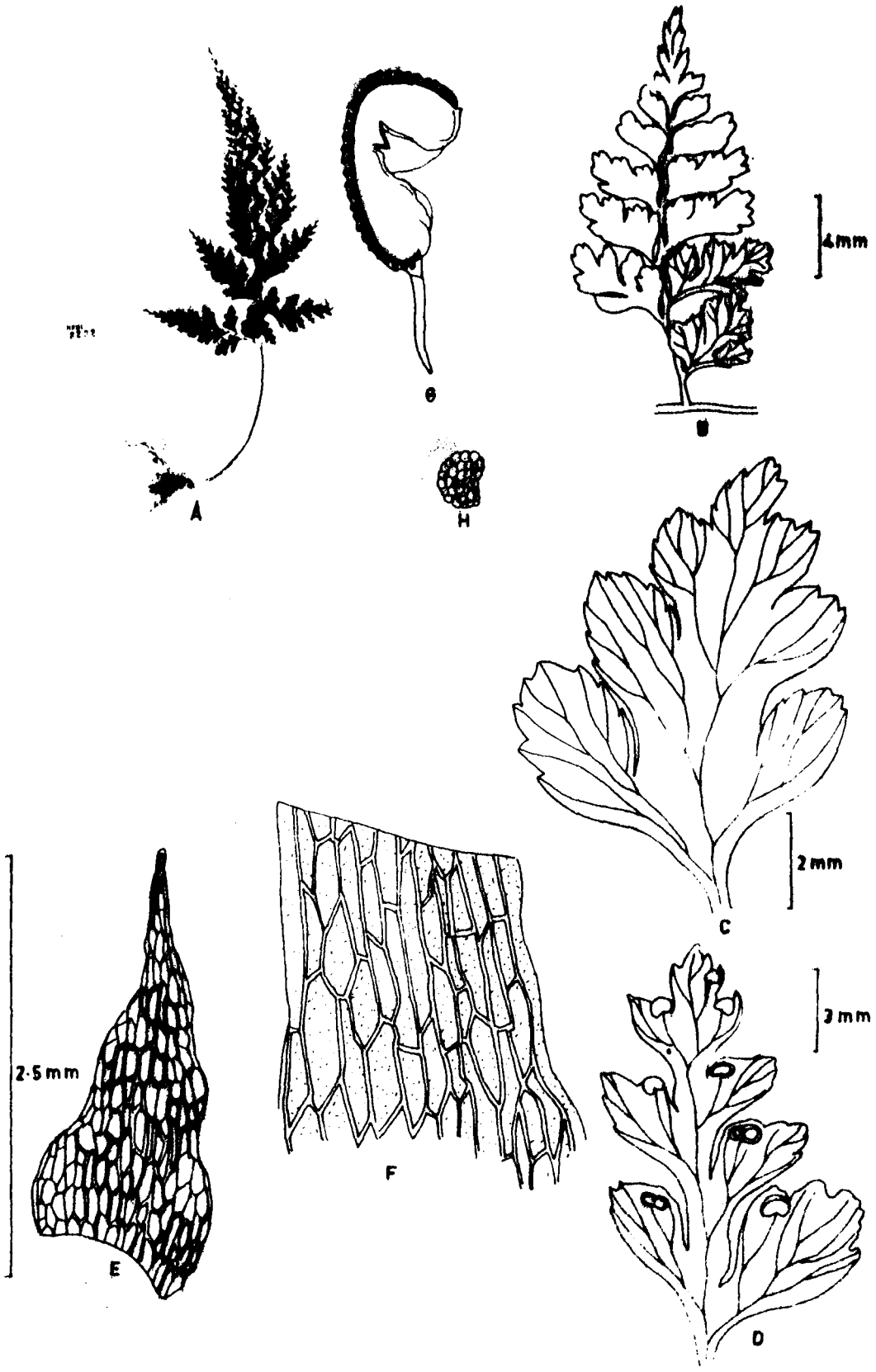


Plate 132: Leucosteria innerva (Wall.) Persl. A - Habit; B - portion of pinnule; C - fertile portion of pinnule; D - sterile portion; E - rhizome scale; F - portion of rhizome scale enlarged; G - sporangium.

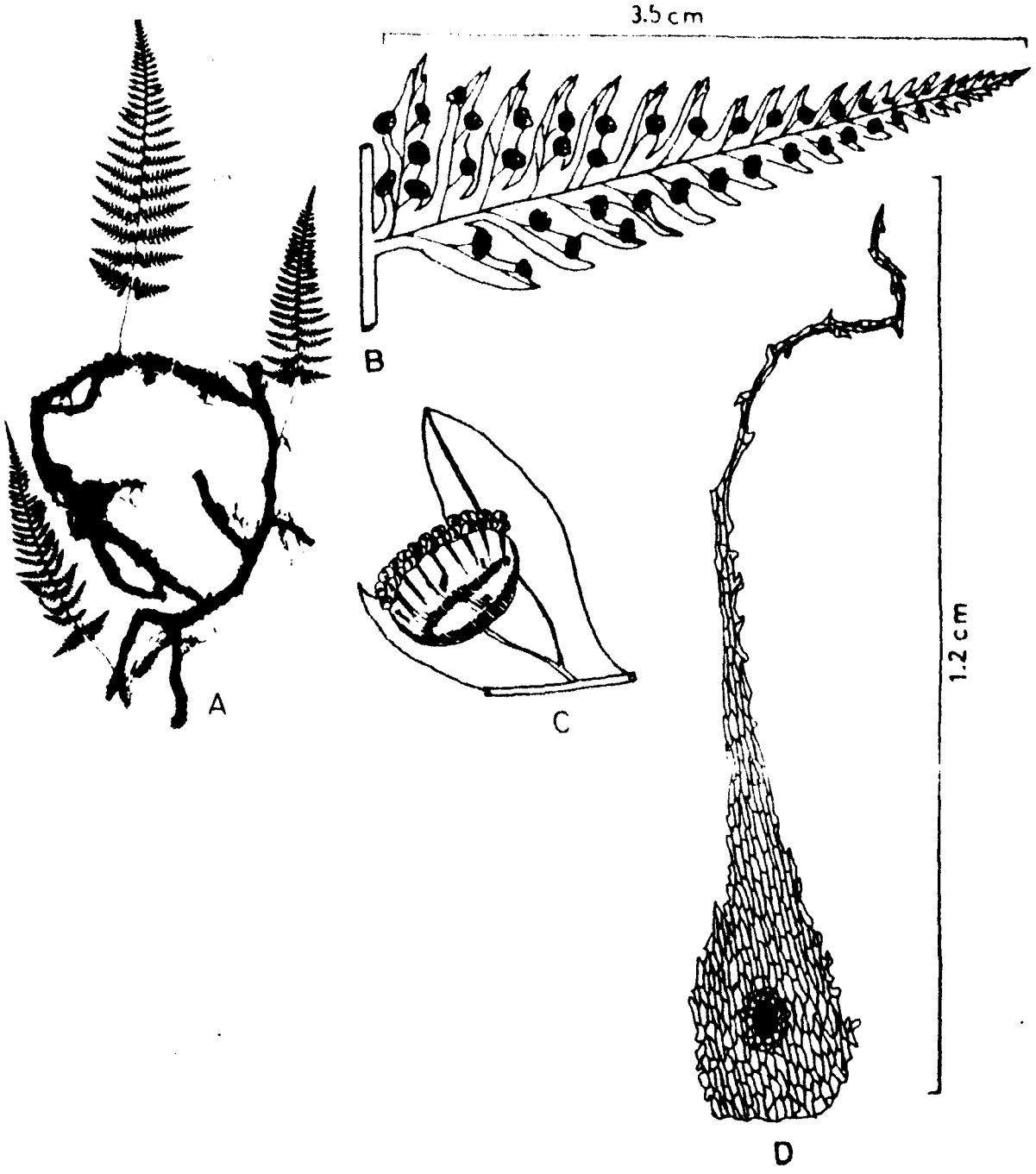


Plate 133: Ariostegia membranulosa (Wall.ex Hook.) Holttum et al.
A - Habit; B - pinna showing venation and sori
C - sorus with indusium; D - rhizome scale.

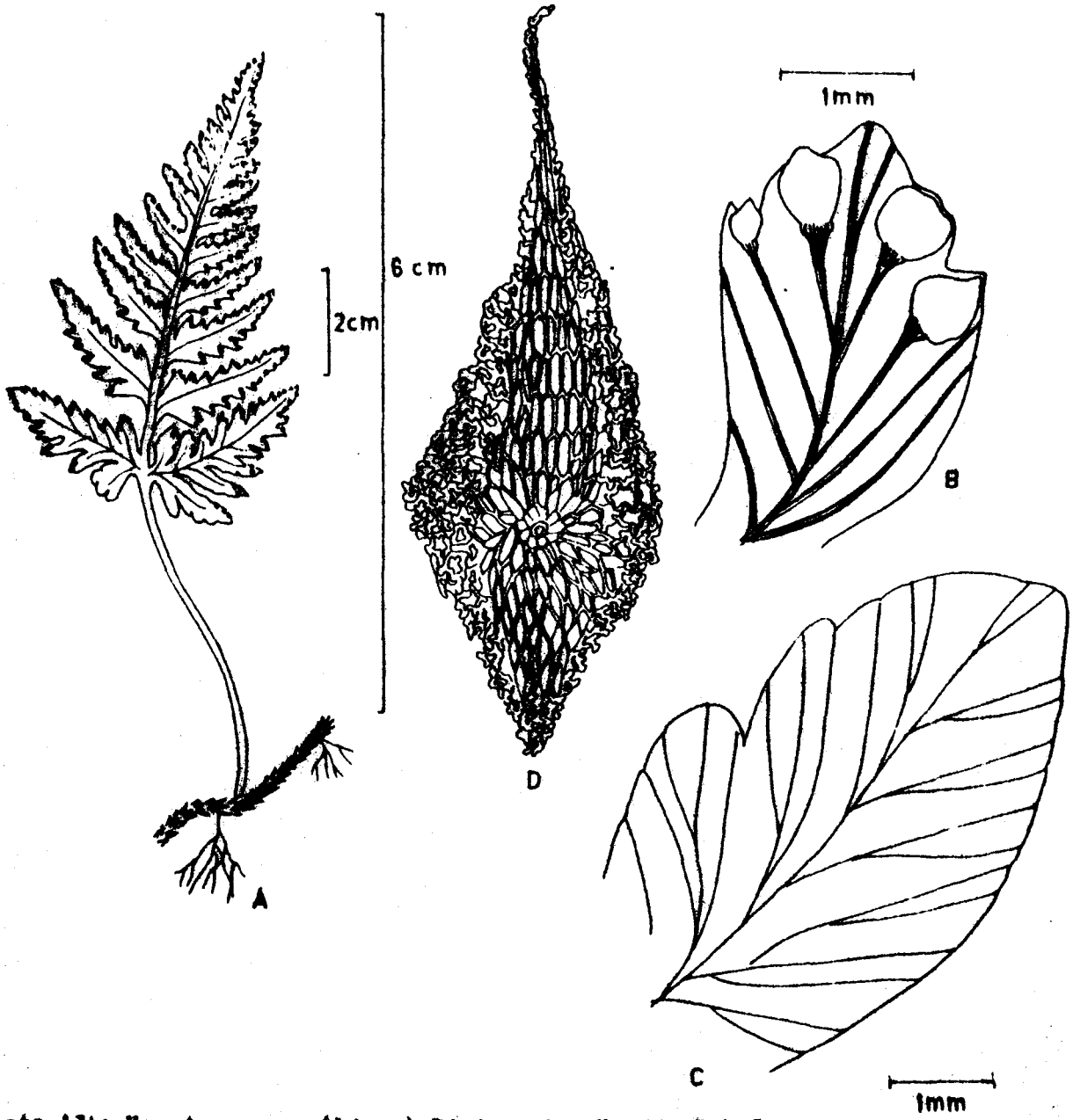


Plate 134: Humata repens (Linn.) Diels A - Habit; B & C - portion enlarged; D - rhizome scale.

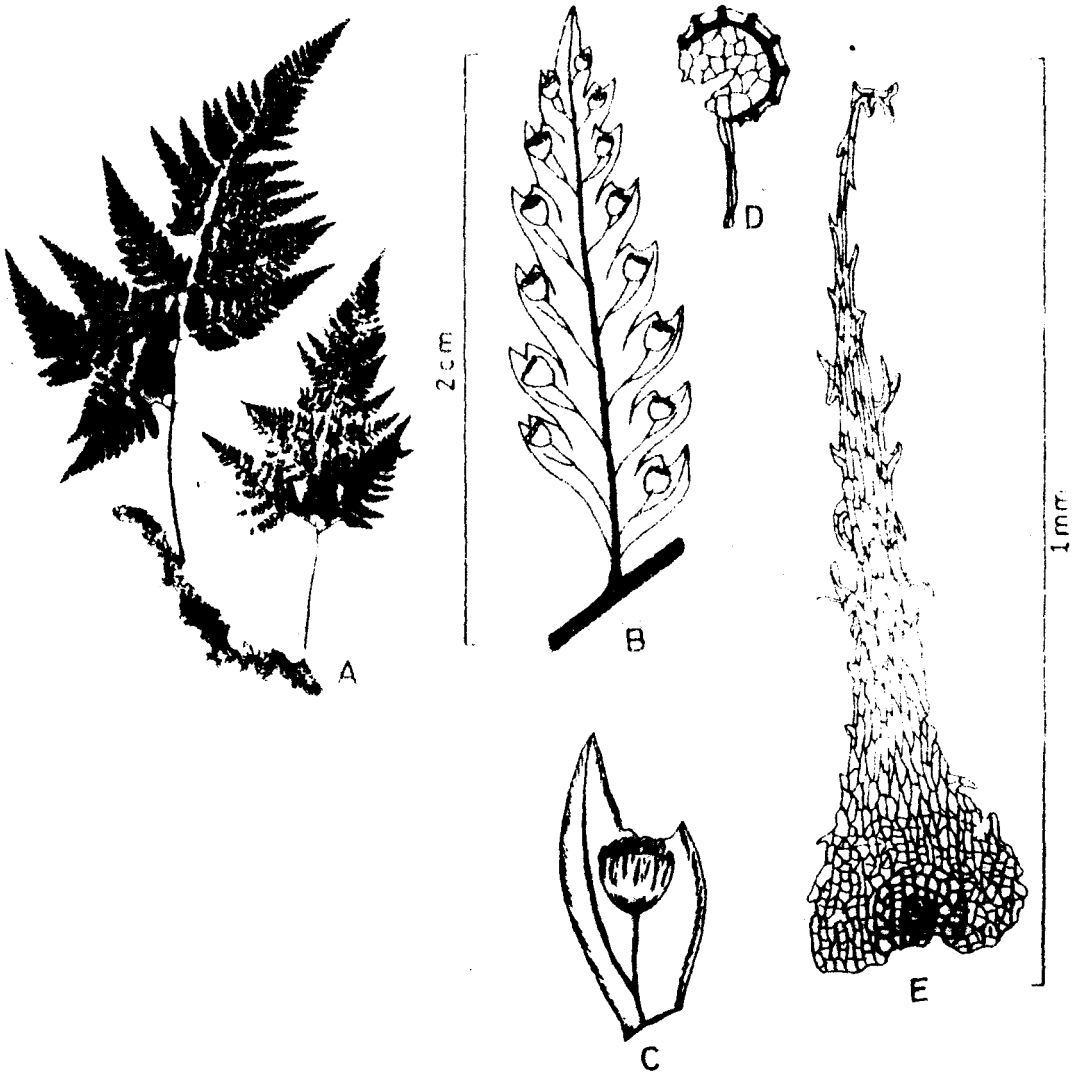


Plate 135: Davallia griffithiana Hook. A - Habit; B - pinna showing venation and sori; C- sorus with indusium; D - sporangium; E - rhizome scale.

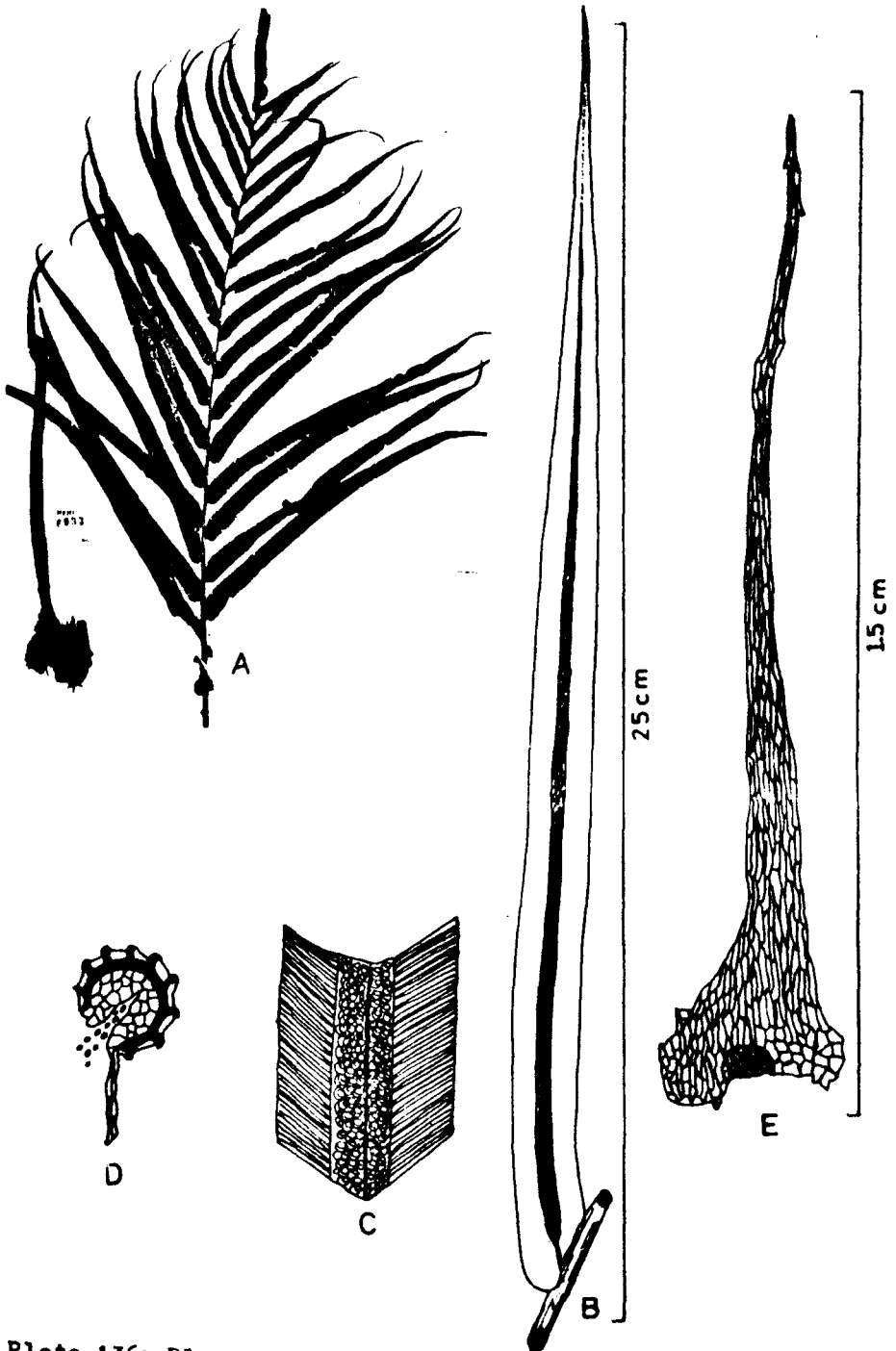


Plate 136: Blechnum orientale Linn. A - Habit; B - fertile pinna; C - a portion of pinna enlarged showing venation; D - sporangium; E - rhizome scale.

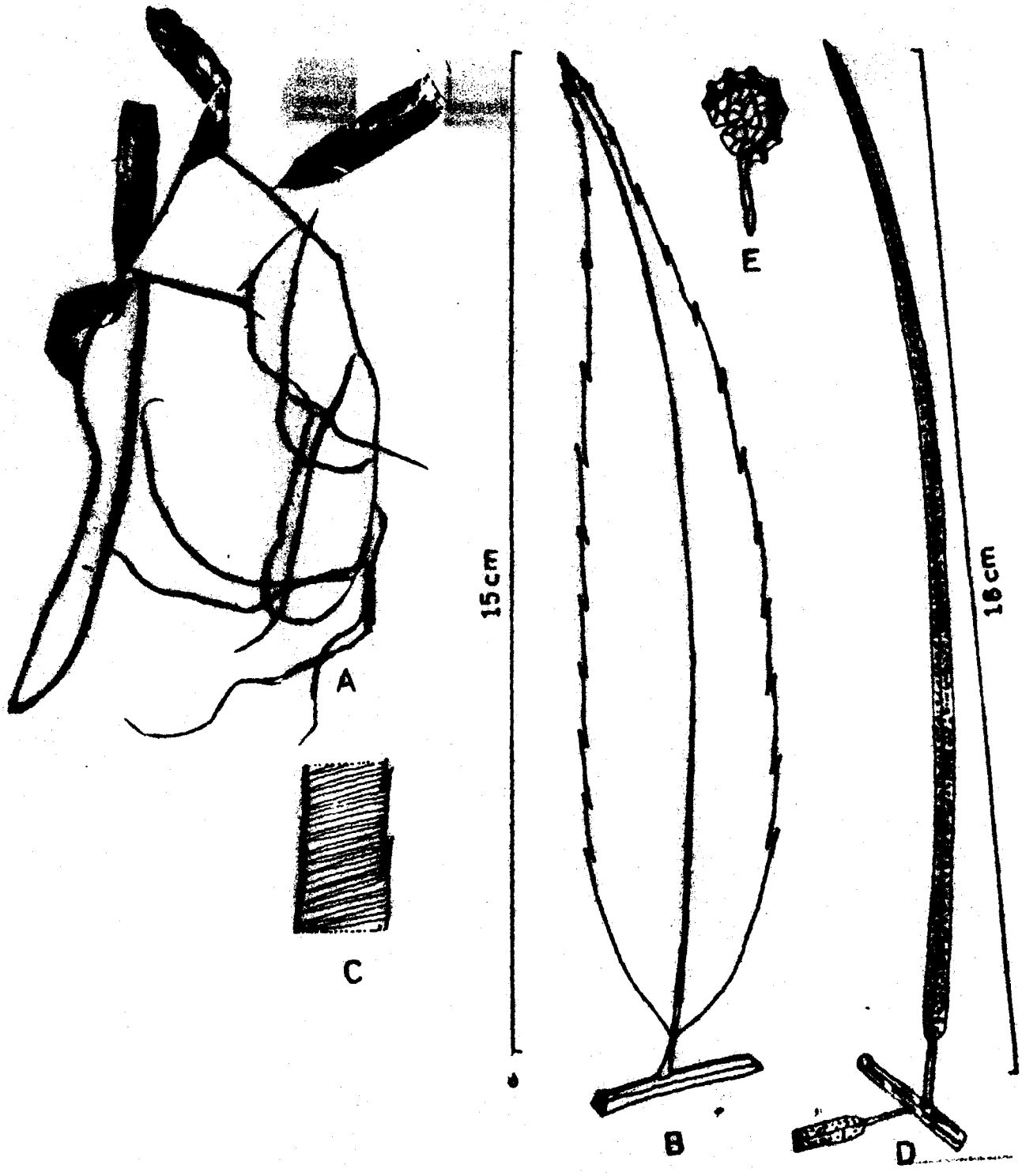


Plate 137: Stenochlaena palustris (Brumf.) Bedd. A - Habit; B - sterile pinna; C - a portion of pinna showing venation; D - fertile pinna; E - sporangium.

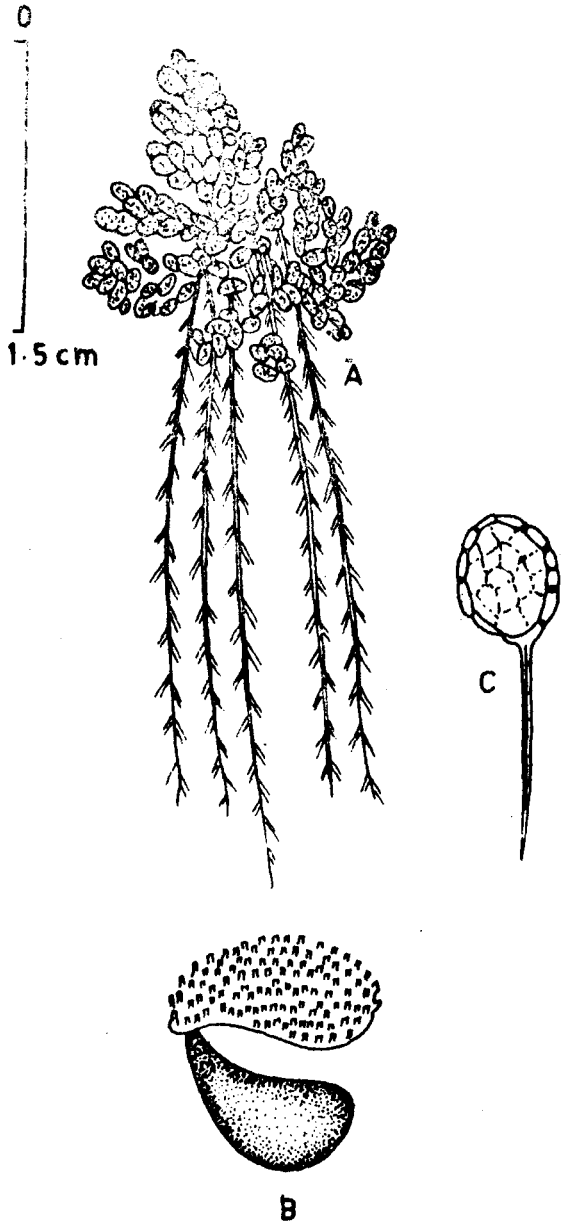


Plate 138: Azolla pinnata R.Br. A - Habit; B - upper floating lobe with papillae & lower submerged lobe; C - sporangium.

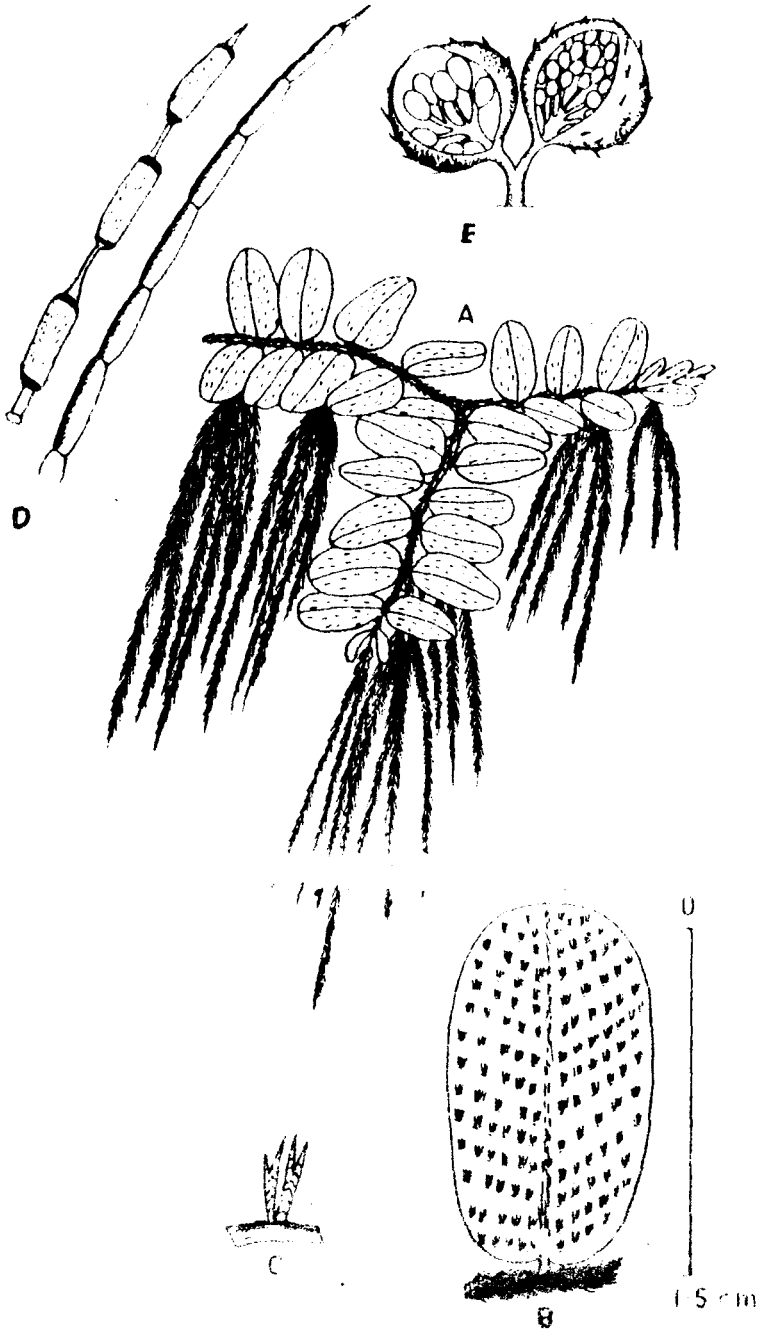


Plate 139: Selaginella kraussiana Hoffm. A - habit; B - floating leaf; C - hairs on papillae; D - multicellular hairs from dissected leaf (rout-[illegible]); E - section of megasporocarp.