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by

K. K. DHIR

with 20 figures



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# FERNS OF NORTH-WESTERN HIMALAYAS

by

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## INTRODUCTION

The ferns constitute a major group of the living pteridophytes and are almost always and everywhere met under favourable conditions of growth. The North-Western Himalayas are not rich in variety of ferns. Only 264 species are estimated from this region on the basis of collections made by the author between 1962-1976 coupled with previous records (Hooker and Baker (1874), Clarke (1880), Beddome (1883, 1892), Blanford (1888), Hope (1899-1904), Duthie (1906), Strachey (1906) and Marten (1909). These are variously adapted to diverse microclimatic habitats in otherwise different types of forests. There is almost a complete lack of information on the ecological aspects of these taxa and their distribution in specific localities in the pioneer comprehensive taxonomic works on Indian pteridophytes by the above mentioned authors. A few fragmentary reports are to date available in this respect (Mehra (1939), Schelpe (1954), Bir (1963), Mehra and Dhir (1968) and Dhir and Sheera (in press) but these do not cover the inner Himalayan ranges.

The present paper deals with the floristic and ecological observations on ferns of North-Western Himalayas. The available information on nomenclatural changes has been incorporated in this account. A brief data about climate, soils and vegetation of the area are also presented here.

## Geographical limits and areas surveyed

The area of present survey lies within an altitudinal range of 300-4,200 m and falls in the states of Jammu and Kashmir, Himachal Pradesh and hill districts of Western Uttar Pradesh. The areas explored, the routes followed and the important places of collection are shown in Fig. 1. The head quarters were made at Chandigarh. The location and average heights above sea level of the principal stations of exploration along with their specific localities are given below.

Jammu and Kashmir: Srinagar ( $34^{\circ}.06'N$ ,  $74^{\circ}.49'E$ , altitude 1800 m): Anantnag (1,590 m), Baramula (1,800 m), Gulmarg (2,655 m), Jammu (335 m), Pahlgam (2,250 m), Sonamarg (2,700 m), Tangmarg (2,535 m), enroute Kolahoi glacier (4,200 m), enroute Amarnath cave (4,200 m).

Himachal Pradesh: Dalhousie ( $32^{\circ}.31'N$ ,  $75^{\circ}.59'E$ , altitude, 2,000 m): Chamba (600 m), Dainkund (2,700 m), Kalatop (2,400 m), Khajjiar (1,600 m), Sherpur (600 m), Kulu (1,200 m), Manali (2,000 m), Manikarn (1,800 m), Rohtang pas (4,200 m).

Himachal Pradesh: Simla ( $31^{\circ}.60'N$ ,  $77^{\circ}.11'E$ , altitude, 2,170 m): Chadwick falls (1,500 m), Glen (1,500 m), Chhrabra (2,430 m), Hattoo Peak (3,150 m), Mashobra (2,400 m), Mattiana (2,230 m), Narkanda (2,680 m), Kalpa valley (900-3,000).

Uttar Pradesh: Mussoorie ( $30^{\circ}.28'N$ ,  $78^{\circ}.10'E$ , altitude 2,000 m): Campty falls (1,300 m), Dehra Dun (680 m), Jabarkhet (2,400 m), Mossy falls (1,500 m), Rajpur (800 m), Sarsar Dhara (750 m), Badrinath (3,100 m), Hemkund (4,300 m), Valley of flowers (3,300 m).

Uttar Pradesh: Nainital ( $29^{\circ}.22'N$ ,  $79^{\circ}.29'E$ , altitude, 1,930 m): Bhimtal (1,300 m), Cheena peak (2,800 m), Haldwani (350 m), Kaladhungi (600 m), Land's end (2,200 m), Lariakanta (2,800 m), Ranibagh (750 m), Tiffontop (2,300 m), Pindari glacier (4,200 m), Jageshwar (1,800 m), Tanankpur (350 m).

## Climate

The climate is very variable in the vast ranges of the Western Himalayas. It is much more moist in the eastern part in contrast to the extreme west owing to gradual westward decrease in precipitation. The meteorological data of the important stations are incorporated in Table 1. The following two places merit special mention:

Nainital marking the eastern corner of the region receives on an average 2,597.5 mm of annual rainfall. The chief amount, 2,239.4 mm falls during the monsoon season from June to October. The monsoons are heaviest in July and August with a monthly precipitation of about 750 mm. The winter months, November to March, are quite dry with less than 60 mm of rain per month, excepting January when a few good showers and snowfalls are experienced. The period between November and December is almost dry. The yearly mean maximum temperature is  $18.33^{\circ}\text{C}$  and mean minimum  $10.40^{\circ}\text{C}$ . January is the coldest month with the lowest minimum temperature touching the freezing point.

Srinagar demarcates the western end. This station records the least annual rainfall of 664.0 mm. The major amount of precipitation, 390.7 mm, is in the form of snow and is received in the months of January to May. The rainy months are July and August. January is the coldest month with temperatures much below the freezing point but humidity is maximum (88%).

## Soils

The important soil forming rocks of the sub-Himalayan tract are of tertiary sediments but the main Himalayan ranges are composed of a group of paragneisses, hybrid gneisses and schists, with intrusions of granite. The central gneiss of acid intrusions is also prevalent. The soil, in general, is composed of brown and red clay covered over in the forest by a thick humus layer varying from 2-8.5 cm in depth.

Table II:

Meteorological data for Srinagar, Dalhousie, Simla, Mussoorie and Nainital (normal for 30 years, 1930-1960)

Station	Element	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Srinagar	Mean Max. Temp. °C	4.4	7.9	13.4	19.3	24.7	29.0	30.8	29.9	28.3	22.6	15.5	8.8
	Mean Min. Temp. °C	-2.3	-0.8	5.5	7.9	11.2	14.4	18.4	17.9	12.7	5.7	-0.8	-1.8
	Relative humidity: Morning at 08.30 hrs, I.S.T.	88.0	87.0	84.0	77.0	71.0	75.0	73.0	79.0	77.0	82.0	85.0	88.0
	Rainfall in mm	72.8	72.3	104.1	78.1	63.4	35.6	61.0	62.8	31.8	28.7	17.5	35.9
Dalhousie	Mean Max. Temp. °C	10.9	13.5	17.7	22.8	25.9	27.9	23.7	22.7	23.0	21.6	18.5	15.1
	Mean Min. Temp. °C	2.1	4.1	8.0	11.9	15.7	18.1	16.8	16.5	15.4	11.7	7.8	5.1
	Relative humidity: Morning at 08.30 hrs, I.S.T.	67.0	62.0	60.0	55.0	59.0	63.0	86.0	91.0	84.0	64.0	53.0	55.0
	Rainfall in mm	204.8	153.9	148.5	77.2	67.9	117.2	619.2	615.2	298.8	83.3	21.4	83.8
Simla	Mean Max. Temp. °C	8.5	10.1	14.4	19.2	23.4	24.3	21.0	20.1	20.0	17.9	15.0	11.3
	Mean Min. Temp. °C	1.9	3.1	6.8	11.2	15.0	16.2	15.6	15.2	13.8	10.8	7.3	4.2
	Relative humidity: Morning at 08.30 hrs, I.S.T.	48.0	45.0	36.0	32.0	34.0	53.0	86.0	89.0	75.0	47.0	31.0	36.0
	Rainfall in mm	65.2	47.6	38.1	37.6	53.7	147.5	414.5	385.4	195.2	45.4	6.7	23.7
Mussoorie	Mean Max. Temp. °C	10.2	11.9	16.2	21.1	24.8	24.1	20.8	20.2	19.9	18.7	15.8	12.7
	Mean Min. Temp. °C	2.5	3.7	7.2	11.8	15.1	16.4	15.9	15.6	14.3	11.1	7.4	4.3
	Relative humidity: Morning at 08.30 hrs, I.S.T.	58.0	56.0	49.0	44.0	46.0	68.0	93.0	95.0	86.0	63.0	49.0	50.0
	Rainfall in mm	66.4	66.9	63.5	29.5	45.1	188.5	728.5	754.7	323.2	32.8	7.7	31.3
Nainital	Mean Max. Temp. °C	10.3	13.1	16.7	21.2	24.0	24.0	21.4	21.2	20.9	18.5	15.7	13.1
	Mean Min. Temp. °C	1.6	4.1	7.9	12.1	15.4	16.9	19.9	16.4	14.9	9.8	5.6	3.5
	Relative humidity: Morning at 08.30 hrs, I.S.T.	66.0	47.0	45.0	36.0	43.0	63.0	86.0	87.0	79.0	58.0	53.0	59.0
	Rainfall in mm	117.5	44.0	53.7	24.7	75.5	273.3	769.3	560.7	330.8	305.2	7.4	35.3

The Siwalik series running along the whole length of the Himalayas are characterized by fine grained, grey micaceous, paper and salt sand-stone, while the cover is formed of earthy clays indistinguishable from the alluvium of plains and conglomerates of crystalline and metaphoric rocks of Himalayan origin. In the Bhabar forests, the soil is composed of sand, gravel and boulders with low water table.

In Kashmir valley, the soils are texturally clay-loam to loam and their nitrogen content is usually high. The soil is brown under the deodar forest.

The Himachal Pradesh soils are sandy-loam to loam in texture and light grey to brown in colour. Generally soil is not very deep and is embedded with pebbles, stones and boulders. Above 1,500 m the soil is often quite deep, light to dark brown in colour and fine in texture varying from silt-loam to loam. The shallow brown soils in Kalpa and Pangri valleys are suitable for the growth of *Pinus gerardiana*.

The soils of Uttar Pradesh vary from red-loam to brown forest soil. The former type is prevalent along the hill slopes and ridges and the latter develops near orchards and cultivated lands. The meadow soil is usually met near nallahs and cool and low-lying shady places which house a large number of lithophytes and ravine ferns.

#### General aspect of vegetation\*

The western Himalayas harbour rich flora and differ from their eastern counterpart in the greater representation of conifers. The vegetation shows a considerable resemblance to the European element, especially in Kashmir valley. The wide range of altitude, temperature, rainfall and soil result in diversified forests in the region. The northern slopes, which retain snow and moisture for a longer period, are often thickly clad with dense forests. On the contrary, the southern slopes support poor vegetation.

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\*Based on author's observations and Mehra et al. (1971)

The plains, the Siwaliks and the outer Himalayan ranges up to 1,000 m comprise the tropical zone. *Shorea robusta* is the dominant species in many forests. It is often associated with *Pinus roxburghii* towards its upper limit. Commonly mixed with it in the lower hills are *Terminalia* sp., *Adina cordifolia*, *Syzygium cumini*, *Cordia dichotoma*, *Cedrela toona*, *Lannea coromandelica* and *Anogeissus latifolia*. The lower storey serves as a host for the epiphytic ferns and it is constituted of *Mallotus philippinensis*, *Emblica officinalis*, *Ehretia laevis*, *Wendlandia exserta*, *Flacourtia indica* and *Acacia catechu*.

The chief constituents of the tropical dry deciduous forests are xerophytic shrubs and trees such as *Sapium insigne*, *Acacia catechu*, *Albizzia lebbek*, *Pyrus padus*, *Bauhinia variegata*, *Zizyphus jujuba* and *Dendrocalamus strictus*. Sometimes biotic factors like lopping, overgrazing and fires result in scrub vegetation. *Euphorbia royleana* is quite conspicuous in such places.

In sub-tropical zone (1,000-1,800 m) *Pinus roxburghii* forms pure forests. At upper limits there is a thin mixture of smaller trees of *Quercus incana*, *Rhododendron arboreum*, *Lyonia ovalifolia*, *Quercus glauca*, *Acer oblongum*, *Myrsine semiserrata* and *Ficus palmata*. Scattered trees of *Terminalia chebula*, *Pyrus pashia* and *Syzygium cumini* are encountered in the lower hills. Pine forests are absent in Kashmir. The pioneer species in dry evergreen forests of the subtropical zone are *Acacia modesta* and *Dodonaea viscosa* and the climax vegetation consists of *Olea cuspidata* forests.

The forests of temperate zone (1,800-3,600 m) are characterized by the presence of evergreen oaks and conifers over extensive areas. Very often these occur in pure communities. Each of the three altitudinal oak belts has its specific conifer. *Quercus incana* occupies the lowest zone of moist temperate forests between 1,800-2,400 m occasionally descending to 900 m on southern slopes in moist ravines. The typical associates are *Rhododendron arboreum*, *Lyonia ovalifolia*, *Ilex dipyrena*, *Betula alnoides*, *Carpinus viminea*, *Cedrela serrata*, *Euonymus pendulus* and *Acer* spp. *Quercus glauca* is locally abundant at lower elevations in shady places. The characteristic conifer of this belt is *Cedrus deodara* which ascends to 2,700 m. *Picea smithiana*



and *Pinus excelsa* are thinly mixed with it. Most frequently broad-leaved associates are *Quercus dilatata* and *Prunus cornuta*. The middle oak zone between 2,000-2,700 m is occupied by *Quercus dilatata* with *Picea smithiana* as the commonest conifer associate. *Quercus incana* and *Q. semicarpifolia* penetrate freely into this belt. The other commonly dispersed trees are *Euonymus pendulus*, *Ilex dipyrena*, *Rhododendron arboreum*, *Rhamnus purpureus*, *Cedrela serrata*, *Machilus* sp., *Fraxinus micrantha*, *Acer caesium* and *Betula alnoides*.

The high altitude oak is *Quercus semecarpifolia*. A thin mixture is found with this species of *Abies pindrow*, *Picea smithiana*, *Cedrus deodara*, *Rhododendron arboreum*, *Salix daltoniana*, *Taxus baccata*, *Pyrus lanata* and *Betula utilis*.

The temperate mixed coniferous forests consist of varying mixture of conifers such as *Abies pindrow*, *Picea smithiana*, *Pinus wallichiana* and *Cedrus deodara*. The broad-leaved trees, intermixed with them or occasionally forming strips and patches are *Quercus semecarpifolia*, *Q. dilatata*, *Juglans regia*, *Prunus cornuta*, *Acer* spp. and *Aesculus indica*.

In moist depressions and along streams the temperate deciduous forests are constituted of *Aesculus indica*, *Juglans regia*, *Fraxinus micrantha*, *Betula alnoides*, *Ulmus wallichiana*, *Carpinus viminea*, *Quercus semecarpifolia*, *Acer* spp., *Prunus cornuta*, *Rhododendron arboreum* and *Taxus baccata*. In the inner ranges the monsoon is feeble and the precipitation, which is usually under 1,000 mm, falls in the form of snow. *Pinus gerardiana* is the principal species mixed with *Juniperus macropoda*, *Artemesia maritima*, *Quercus ilex*, *Fraxinus xanthoxyloides* and *Olea cuspidata*.

Alpine scrub vegetation stretches throughout the western Himalayas above 3,600 m. The elements are bushy and have short and much branched stems. Dwarf willows and Junipers are abundant in some localities. *Rhododendron campanulatum* and *R. barbatum* are conspicuous at other places. Under them *Cotoneaster* spp. commonly form mats on rocks. *Betula utilis*, *Syringa emodi* and *Salix* spp. constitute the deciduous scrub near Aparwat (3,700 m) in Kashmir.

## ECOLOGICAL OBSERVATIONS

A vast majority of ferns grow under temperate and subtropical climates in the Himalayas, whereas a few occur in the alpine and dry tropical conditions. Some species tend to be locally abundant and almost cover the ground lending a characteristic feature to the landscape.

On the basis of their growth habit and habitat the ferns of the region under consideration may be classified into the following ecological categories. Only the more prominent species are referred to in each case.

### EPIPHYTES

The epiphytic vegetation goes on decreasing as one proceeds westwards. From Kashmir valley in the extreme west of the Himalayas, only two epiphytic ferns, *Lepisorus excavatus* (Bory) Ching and *L. nudus* (Hook.) Ching have been presently recorded. On the contrary, epiphytes are abundant in the Kumaon hills marking the eastern limit of the area under review. The composition of the epiphytic flora changes markedly with altitude, climate and nature of the forest, i.e., whether dark and shady or with open lax crown allowing plenty of light to penetrate through it. The conifers, generally, do not harbour any epiphytes, perhaps due to their resinous bark. Whenever epiphytes are perched on conifers, the trunks of such trees have been seen to be fully laden with mosses and bear a thick coverage of humus.

#### Low and Middle Hill Epiphytes (500-1,500 m)

These are frequent only in Kumaon and extend westwards as far as Simla hills, beyond which these have not been noticed by the author. Since there is relatively high temperature and low humidity, the ferns show various contrivances to retain the available moisture.

*Pyrrosia mollis* (Kze.) Ching, *P. manni* (Gies.) Ching, *P. pansa* (Mett. ex Kuhn) Ching and *P. flocculosa* (D. Don) Ching are the conspicuous species on trunks of broad-leaved trees in Bhabar forest (Kumaon) though scarce around Jageshwar and Badrinath in the inner Himalayan ranges. A thick felt of stellate hairs on the under surface of fronds absorbs and retains moisture received during the rains and also prevent excessive transpiration in drought conditions. *Lepisorus nudus* (Hook.) Ching is occasionally seen at 1,500 m on exposed tree-trunks growing on the ridges. It is capable of rolling the frond margins inwards to conserve water in dry weather.

#### Upper Hill Epiphytes (1,500-2,400 m)

Epiphytes are well represented in this zone. They appear on the advent of monsoons and grow prolifically giving a conspicuous feature to the landscape. After rainy season the fronds wither and are dropped. The rhizomes become dormant to renew their activity during the next favourable season. Such epiphytes grow on trunks and branches which are thickly clad with felts of mosses and leafy liverworts which retain lot of moisture and provide adequate coverage and protection to the growing rhizomes.

The upper hill epiphytes may further be classified as follows:

##### 1. Foot epiphytes

Such ferns have almost always been seen in moist and thickly shaded forests. Starting from the base of tree-trunk they reach up to 1.5 m above the ground. They are well protected from strong winds and sharp fluctuations in temperature due to their being near the soil surface. They receive intermittent washings from the crown and tree-trunk during the rains. The characteristic foot epiphytes in the area are the filmy ferns, *Didymoglossum insigne* v.d. B. and *Mecodium exsertum* (Wall. ex Hook.) Copel. They have delicate fronds which curl during a spell of dry

weather and shrivel up in the unfavourable season. Some species like *Onychium contiguum* Wall. ex Hope, *Microsorium membranaceum* (D. Don) Ching and *Asplenium dalhousiae* Hook. which normally grow on the forest floor, occasionally behave as foot epiphytes

## 2. Branch epiphytes

Some of the delicate epiphytic ferns which require protection from wind and direct exposure for their luxuriant growth, grow in the middle of the crown among the shade of leaves. These are commonly associated with epiphytic orchids like *Cymbidium giganteum* Wall., *Coelogyne cristata* Lindl., *Dendrobium* spp. and other angiosperms like *Sedum trifidum* Wall. and *S. multicaule* Wall.

In the forests with lax crown, which are frequent in the area surveyed, the epiphytic vegetation is more exposed to sun's rays and fluctuations in the environmental conditions. The common ferns are *Lepisorus excavatus* (Bory) Ching, *L. kashyapii* (Mehra) Mehra, *Polypodium microrhizoma* Clarke ex Bak. (Fig. 2), *P. argutum* Wall. ex Hook., *P. amoenum* Wall. ex Mett., *P. lachnopus* Wall. ex Hook., *Araiostegia pseudocystopteris* (Kze.) Copel. *A. pulchra* (D. Don) Copel., *Loxogramme involuta* (D. Don) Presl and *Arthromeris wallichiana* (Spr.) Ching (Fig. 3). *Vitraria flexuosa* Fee, *Oleandra wallichii* (Hook.) Presl and *Lepisorus loriformis* (Wall. ex Mett.) Ching are quite common in the forest of Pinder gorge, Jageshwar and Kilbri range in Kumaon. These show graceful pendant habit hanging from the branches of medium-sized trees. *Asplenium ensiforme* Wall. ex Hook. et Grev. and *Loxogramme involuta* (D. Don) Presl are occasionally associated with these species.

## 3. Tree top epiphytes

The environmental conditions at tree tops show sharp diurnal fluctuations. The species, *Lepisorus excavatus* (Bory) Ching,

*L. leiopteris* (Kze.) Bir & Trikha and *L. kashyapii* (Mehra) Mehra possess leathery texture to prevent loss of water. Their root systems are more prolific and wiry thus anchoring them to the substratum strongly so as to withstand the wind velocity.

#### 4. Mossy forest epiphytes

The tops of the ridges bear a single storey of short and stunted trees perhaps because of their direct exposure to strong winds. The trees receive maximum rains and their branches remain virtually immersed in cloud and fog. Consequently, they become thickly clad with liverworts and mosses providing an ideal substratum for epiphytes like *Polypodium argutum* Wall. ex Hook., *P. amoenum* Wall. ex Mett., *Lepisorus excavatus* (Bory) Ching, *L. kashyapii* (Mehra) Mehra and *L. leiopteris* (Kze.) Bir & Trikha. Occasionally, *Asplenium laciniatum* D. Don, *A. ensiforme* Wall. ex Hook. et Grev. *Lepisorus loriformis* (Wall. ex Mett.) Ching and *Vittaria flexuosa* Fée are also seen.

#### Rhododendron-Conifer Zone Epiphytes (2,400-3,600 m)

The epiphytic vegetation decreases considerably with altitude but *Quercus semecarpifolia* Sm. is a good host for some ferns at higher elevations. The common species are *Lepisorus clathratus* (Clarke) Ching (Fig. 4), *L. excavatus* (Bory) Ching, *Arthromeris lehmanni* (Mett.) Ching, *A. wallichiana* (Spr.) Ching, *Phymatodes malacodon* (Hook.) Ching, *P. stracheyi* Ching, *Araiostegia delavayi* (Bedd. ex Clarke et Bak.) Ching and *Phymatodes stewartii* (Bedd.) Ching. *Notholaena marantae* (L.) R. Br. is a rare epiphyte. It was observed by the author around Hemkund only.

#### CLIMBERS

The climbing ferns are met at low altitudes (below 1,000 m),

especially common in Bhabar forest, and are represented by 3 species of *Lygodium*, *L. flexuosum* (L.) Sw. (Fig. 5), *L. japonicum* (Thumb) Sw. and *L. circinatum* (Burm.) Sw. The rhizome of these ferns grows underground and is creeping, while the sensitive rachis of fronds is responsible for climbing. It twines round the neighbouring branches of the host. The lower pinnae are larger and always sterile, whereas the upper smaller ones are fertile perhaps because they receive optimal photoperiod.

#### SPECIES INHABITING FOREST FLOOR AND FOREST BORDERS

The fern flora of mountains is luxuriant due to greater atmospheric moisture, frequent fog and clouds than in the lowlands. Also the streams and rivulets are numerous affording ideal sites along their banks for growth. Often the ferns grow in such great abundance that they lend a peculiar charm to the localities of their occurrence. Majority of the species of such habitats belong to the genera *Pteris* Linn., *Dryopteris* Adanson, *Polystichum* Roth, *Athyrium* Roth, *Diplazium* Swartz, *Thelypteris* Schmidel and *Cyclosorus* Link.

The forest soil of the outer low hills is poor in humus, non-acidic, and mainly clayey and thus unsuitable for fern habitation. On favourable sites, however, like Bhabar forest in Kumaon, *Diplazium maximum* (D. Don) C. Chr. and *D. esculentum* (Retz.) Sw. are locally abundant and cover vast areas of forest floor. The well-lighted margins of forest floor are inhabited by *Pteris vittata* Linn., *Cyclosorus dentatus* (Forssk.) Ching, and *Pteris biaurita* Linn. *Equisetum debile* Roxb. is often met on gravelly soil along the streams.

The low altitude inner valleys of the Western Himalayas like the Ganges valley in Garhwal and Sarju valley in Kumaon harbour a fairly rich fern flora. *Cyathea spinulosa* Wall. ex Hook. has been discovered here for the first time marking the western limit of the species. Only a few individuals showing stunted growth were observed on the forest floor along a streamlet. Other ferns seen under similar conditions are *Pronephrium nudatum* (Roxb.) Chandra, *Osmunda regalis* Linn. and *Diplazium gigan-*



*teum* (Bak.) Ching. Well-lighted and exposed fringes of forest floor are frequently colonized by *Pteris vittata* Linn., *P. biau-rita* Linn., *P. dactylina* Hook., *Thelypteris repens* (Hope) Ching, *Cyclosorus dentatus* (Forssk.) Ching and *Sphenomeris chinensis* (L.) Maxon. In Sarju valley, in somewhat shaded conditions, *Pteris subquinata* Wall. ex Hope with its 5-fid stately fronds is locally abundant.

At higher elevations (1,200-3,600 m) the conditions are more favourable for fern growth because of the thick humus layer covering the soil surface, presence of sufficient moisture and optimum density of shade. The ferns grow gregariously, sometimes obliterating footpaths. However, their intensity, both in number of species and individuals, goes on decreasing westwards. The fern flora of Kashmir valley is of particular interest in that it differs from rest of the Himalayas and shows some resemblance with the European elements. Special mention may here be made of the dry and arid Kalpa valley with bare rocky steep slopes banking the river Suttlej. *Pinus girardiana* Wall. is the conspicuous tree forming almost pure formations which render the soil unsuitable for undergrowth. However, some sheltered places house a few sturdy species like *Athyrium filix-foemina* (L.) Roth, *A. clarkei* Bedd., *Gymnopteris vestita* (Wall. ex Moore) Und. and *Ceterach officinarum* DC. Colonies of *Equisetum arvense* Linn. are seen on gravelly soil along the streamlets. In still more shaded places, especially along the margins of cultivated lands, *Asplenium septentrionale* (L.) Hoffm., *Cystopteris fragilis* (L.) Bernh., *Diplazium giganteum* (Bak.) Ching, *Dryopteris ramosa* (Hope) C. Chr. and *Thelypteris levingei* (Clarke) Ching have been recorded.

Generally within an altitudinal range of 1,200-1,800 m, the common ferns are *Dryopteris marginata* (Wall. ex Clarke) Christ, *D. odontoloma* (Moore) C. Chr., *Athyrium pectinatum* Presl, *Pteris cretica* Linn., *P. stenophylla* Wall. ex Hooke et Grev., and *P. wallichiana* Ag. On the exposed ridges large colonies of *Dryopteris chrysocoma* (Christ) C. Chr. occur frequently replacing *D. cochleata* (D. Don) C. Chr. which ascends only upto 1,500 m.

At elevations between 1,800-2,400 m, the forests are consider-

ably rich in Pteridophytes. Moss laden boulders harbour a number of humicoles such as *Adiantum venustum* D. Don, *Asplenium varians* Wall. ex Hook. et Grev., *A. trichomanes* Linn. and *A. fontanum* (L.) Bernh. *Pteris wallichiana* Ag. is the most outstanding undergrowth of *Quercus incana* Bartr. forest around Loharkhet (Kumaon) (Fig. 6). *Diplazium polypodioides* Blume and in certain localities, *Dennstaedtia appendiculata* (Wall. ex Hook.) J. Smith (Fig. 7) form conspicuous colonies near watery places. Along the footpaths in moist and shaded hill sides, *Pteris cretica* Linn. (Fig. 8), *Onychium contiguum* Wall. ex Hope, *Coniogramme caudata* (Wall. ex Etting) Ching, *Dryopteris odontoloma* (Moore) C. Chr., *Polystichum aculeatum* (L.) Schott and *Athyrium schimperi* Moug. ex Fée form extensive patches. Isolated individuals of *Polystichum squarrosum* (D. Don) Fée which form beautiful baskets are common under the shade of trees. *Thelypteris brunea* (C. Chr.) Ching is a magnificent species of the exposed situations by the side of water channels. It forms large patches along with *T. repens* (Hope) Ching, *Athyrium clarkei* Bedd. and occasionally *Diplazium polypodioides* Blume. Other important species in such habitats are *Athyrium rupicola* (Hope) C. Chr., *Diplazium giganteum* (Bak.) Ching, *Dryopteris ramosa* (Hope) C. Chr., *Athyrium mackinnoni* (Hope) C. Chr., *Coniogramme intermedia* Hieron. and *Onychium lucidum* (D. Don) Spr. In addition to these *Athyrium foliolosum* Moore ex Sim, *A. fimbriatum* Moore, *A. puncticaule* (Blume) Moore, *Polystichum biaristatum* (Bl.) Moore, *Coniogramme indica* Fée and *Pteris aspericaulis* Wall. ex Agardh are also common in the inner ranges of Kumaon and Garhwal. *Equisetum diffusum* D. Don grows prolifically along water courses. *Athyrium thelypteroides* (Michx.) Desv. makes its appearance at certain places.

The highest zone surveyed frequently extends from 2,400-4,200m. In moist temperate forests where sufficient shade is provided to the ground, *Dryopteris wallichiana* (Spr.) Hyl., a basket forming fern (Fig. 9), is luxuriant, especially near Hattoo (Simla). Its common associates are *D. blanfordii* (Hope) C. Chr., *D. sinofibrillosa* Ching, *Polystichum prescottianum* (Wall. ex Mett) Moore and *Athyrium flabellulatum* (Clarke) Tard., *Athyrium denticerum* (Clarke) Mehra et Bir forms beautiful baskets along the Lidder river of Kashmir valley. *Polystichum discretum*

(D. Don) Diels and *Athyrium thelypteroides* (Michx.) Desv. have also been seen in the same locality. From Khilanmarg (3,300 m) to Aparwat (3,900 m) in Kashmir, large areas are occupied by *Athyrium squamigerum* with its black stiped small fronds. In open situations at 2,700 m near Dainkund (Dalhousie) and Hattoo (Simla) *Onychium contiguum* Wall. ex Hope forms large conspicuous patches (Fig. 10). *Osmunda claytoniana* Linn. grows thickly along the streamlets at 2,700-3,300 m. *Adiantum pedatum* Linn. is a graceful fern along the forest borders near Phurkia (Kumaon). The other note-worthy species that occur at or above 3,000 m are *Polystichum lonchitis* (L.) Roth, *Cryptogramma crispa* (L.) R. Br., *Asplenium rutamuraria* Linn. and *Dryopteris barbigera* (Moore) O. Ktze.

#### RAVINE FERNS

The ravine soil is composed of pebbles and stones along with a little sandy calcareous matter. Many ferns prefer to grow in the ravines along water channels. The principal species are *Polystichum obliquum* (D. Don) Moore, *Pronephrium nudatum* (Roxb.) Chandra, *Woodwardia radicans* (L.) Smith, *Diplazium polypodioides* Blume, *D. latifolium* (D. Don) Moore and *Coniogramme indica* Fée. In Rattighat khud (1,500 m) near Nainital *Thelypteris erubescens* (Wall. ex Hook.) Ching grows lucuriantly. *Thelypteris levingei* (Clarke) Ching forms dense beds (Fig. 11) in between big boulders under the shade of trees in Ferozepur Nallah near Tangmarg (Kashmir). At high elevations near Khilanmarg (3,300 m) *Osmunda claytoniana* Linn. forms bright green patches among the stones. The shining but interrupted green colour, due to the presence of fertile brown pinnae in the centre, makes it quite attractive.

#### THICKET FORMING SPECIES

There are some tough ferns which grow on exposed rocky and gravelly slopes. They are put to a wide variation of atmospher-

ic conditions like high and low wind velocities, marked temperature fluctuations and varied densities of moisture.

*Pteridium aquilinum* (L.) Kuhn ex Decken seems to be the sole true thicket forming species met throughout the Western Himalayas above 1,500 m. It forms huge dark green patches, generally on recently exposed ridges. The rhizome is buried deep under the clayey soil and creeps long distances, branching widely. The new fronds come up at intervals forming a tangled mass difficult to penetrate, which does not allow anything to grow through it.

FERNS GROWING ON EXPOSED ROCKS, BOULDERS OR GRAVELLY SOIL  
ALONG ROADSIDE UNDER EXTREMELY XEROPHYTIC CONDITIONS

The water holding capacity of rocky soils along the roadside is desperately poor. There is no protection against the direct sun and hence the moisture content of the plants is very easily brought down during the sunny hours. These factors result in xerophytic aspect of the vegetation. Such localities are frequent in the Siwalik hills.

The dry boulders and rock walls at low altitudes are largely inhabited by *Cheilanthes farinosa* (sensu Blanford), *C. anceps* Blanford, *C. rufa* D. Don, *C. persica* (Bory) Mett. and *Pellaea nitidula* (Hook.) Bak. Another associate is *Hypodematum crenatum* (Forrsk.) Kuhn with its rhizome densely covered with large golden scales deeply buried into the crevices of rocks.

At higher altitudes, (above 1,800 m) *Cheilanthes albomarginata* Clarke and *C. dalhousiae* Hook. are met on dry rocks. *Gymnopteris vestita* (Wall. ex Moore) Und. is always seen in very arid conditions. The brownish silky scales on the underside of its fronds reduce excessive transpiration.

*Woodsia elongata* Hook. (Fig. 12) sometimes colonises exposed dry rocks at still higher elevations.

## LITHOPHYTES

Lithophytes are those ferns that grow on rocks or prefer crevices of stony walls and embankments of water channels. They seem to need aeration for their roots which is not available in the forest soils. Their behaviour is, thus, much like that of epiphytes. Almost all the epiphytes of the area occur also as lithophytes. But true rock ferns like *Adiantum venustum* D. Don, *A. capillus-veneris* Linn., *Asplenium rutamuraria* Linn., and *A. septentrionale* (L.) Hoffm. are never found as epiphytes. Such ferns love to grow on shaded walls in forests or by streams where the atmosphere is always humid. They have no contrivances either for storage of water or to prevent excessive transpiration.

The lithophytes may be classified into two categories:

- i) Ferns preferring crevices of stone walls and embankments

At altitudes below 1,500 m *Adiantum capillus-veneris* Linn. (Fig. 13) and *A. incisum* Forssk. (Fig. 14) are most conspicuous.

Common lithophytes of higher elevations (1,500-2,400 m) are *Lepisorus excavatus* (Bory) Ching, *L. nudus* (Hook.) Ching and *Polypodium lachnopus* Wall. ex Hook. Very often *Polypodium amoenum* Wall. ex Mett. (Fig. 15) and *P. microrhizoma* Clarke ex Bak. cover large areas of shaded walls.

The other species which deserve mention are *Arthromeris wallichiana* (Spr.) Ching, *A. lehmanni* (Mett.) Ching, *Phymatodes hastata* (Thumb.) Ching, *Pteris vittata* Linn. *Notholaena marantae* (L.) R. Br., *Lindsaya cultrata* (Willd.) Sw. and *Ampelopteris prolifera* (Retz.) Copel. (Fig. 16). The last two species grow gregariously in moist situations.

## ii) Rock ferns

Within an altitudinal range of 1,500-2,000 m *Leucostegia immersa* Wall. ex Presl, *Asplenium unilaterale* Lamk. var. *delicatulum* Par., *Polystichum lentum* (D. Don) Moore, *P. obliquum* (D. Don) Moore, *P. thomsoni* (Hook. fil.) Bedd. and *P. stimulans* (Kze. ex Mett.) C. Chr. are the common rock lithophytes. *Adiantum venustum* D. Don forms large patches on shaded and moist rocks. Among others preferring such habitats reference may be made of *Araiostegia pulchra* (D. Don) Copel, *Asplenium ensiforme* Wall. ex Hook. et Grev., *A. cheilosorum* Kze., *A. laciniatum* D. Don, *A. indicum* Sledge and *A. unilaterale* Lamk. var. *udum* Atk.

Representative species of higher altitudes (2,400-3,300 m) coming under this category are *Woodsia elongata* Hook. and *Polystichum acanthophyllum* (Franch.) Christ. The former possesses long linear fronds drooping from shaded rocks. From Kumaon, *Phymatodes stewartii* (Bedd.) Ching (Fig. 17) has been collected. Small patches of *Asplenium septentrionale* (L.) Hoffm., *A. fontanum* (L.) Bernh. and *A. rutamuraria* Linn are often met in such habitats in Kashmir valley.

## WATER FERNS

The common hydrophytic ferns are *Marsilea minuta* Linn., *Salvinia natans* (L.) All. and *Azolla pinnata* R. Br. var. *imbricata* (Roxb.) Bonap.

*Marsilea minuta* Linn. is met throughout the Western Himalayas from plains to 1,800 m in Khajjiar lake (Dalhousie) and many small lakes of Kashmir valley. The plants always grow along the banks of still waters where it is anchored to the substratum with running stem which roots at intervals. Only the cruciform green leaves are exposed to the surface of water. *Salvinia natans* (L.) All. is abundant in Dal lake (Kashmir). *S. auriculata* Aublet (Fig. 18) is an introduced species and is collected from Khajjiar lake (Dalhousie). Both of them grow gregariously often clothing the water surface. *Azolla pinnata* R. Br. is found



floating on water surface of ponds in the plains forming dense mats (Fig. 19). When fully fertile they develop reddish hue.

#### EVERGREEN FERNS

During several visits to the hills in the months of December and early March, a period considered to be the most unfavourable for fern growth, the author has seen some of the species tolerating the severe winter and perpetuating during the snowy period.

When the snow had just melted in the month of March, the species showing the last year's persistent fronds in the Mussoorie hills are *Cheilanthes albomarginata* Clarke, *Pteris quadriaurita* Retz., *P. cretica* Linn., *P. stenophylla* Wall. ex Hook. and Grev., *Adiantum venustum* D. Don, *Coniogramme fraxinea* var. *denticulato-serrata* Hieron., *Polystichum squarrosus* (D. Don) Fée, *P. aculeatum* (L.) Schott. *P. obliquum* (D. Don) Moore, *Cyrtomium caryotideum* Presl, *Dryopteris ramosa* (Hope) C. Chr., *D. marginata* (Wall. ex Clarke) Christ, *D. odontolona* (Moore) C. Chr., *Diplazium spectabile* (Wall. ex Mett.) Ching, *D. polypodioides* Blume, *Thelypteris erubescens* (Wall. ex Hook.) Ching, *Cyclosorus dentatus* (Forssk.) Ching, *Pronephrium nadatum* (Roxb.) Chandra, *Asplenium varians* Wall. ex Hook. and Grev., *A. trichomanes* Linn., *A. eximium* Bedd., *A. dalhousiae* Hook., *Woodwardia radicans* (L.) Smith, *Loxogramme involuta* (D. Don) Presl, *Lepisorus nudus* (Hook.) Ching and *Arthomeris wallichiana* (Spr.) Ching. Along with these, sturdy fern-allies like *Equisetum diffusum* D. Don and *E. ramosissimum* var. *altissimum* A. Br. were also collected

#### ENUMERATION OF THE GENERA AND SPECIES

The arrangement of the families of ferns followed presently is according to the phylogenetic scheme proposed by Prof. Mehra (1961b). The species marked with asterisk (\*) were not collect-

ed by the author but they have been reported by other workers from the area. The information concerning these species has been incorporated from Beddome (1883, 1892), Clarke (1880), Hope (1899-1904), Mehra (1939), Stewart (1942, 1945), and notes on the sheets in the two national herbaria at the Indian Botanic Gardens, Calcutta, and the Forest Research Institute, Dehra Dun, which were frequently visited by the author. Abbreviations for these two herbaria mentioned in the text for these specimens are CAL and DD respectively. Short notes are added in case of some of the species. It was not intended to give complete synonymy. Only references to the Indian literature have been made.

#### OPHIOGLOSSACEOUS SERIES

Family Ophioglossaceae

##### *BOTRYCHIUM* Swartz

1. *B. LANUGINOSUM* Wall. ex Hook. et Grev., Ic. Fil., t. 79, 1829; Clausen, Mem. Torrey Bot. Cl., 19 (2), 96, 1938; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 102, 1964; Panigrahi and Dixit, Proc. Nat. Inst. Sci. India, 35, 242, 1969.

Syn.: *Botrychium virginianum* (L.) Sw., (Schrad. Jour. 18002, 111, 1801) var. *lanuginosum* Bedd. Handb. Ferns Brit. India, 471, t. 295, 1883. *Osmundopteris lanuginosa* (Wall. ex Hook. et Grev.) Nishida, Jour. Jap. Bot., 27, 276, 1952.

*Japonobotrychium lanuginosum* (Wall. ex Hook. et Grev.) Nishida ex Tagawa, Jour. Jap. Bot., 33, 201, 1958.

It is commonly met around Nainital, 2,200 m. Loharkhet, 2,400 m (Almora) and Hemkund 2,100-2,700 m. (Garhwal) but seems to be occasional at Mussoorie and rare at Simla and Dalhousie.

Grows in exposed conditions on the soil or on rocky walls where sufficient humus has accumulated.

An abnormal specimen collected from Nainital shows the presence of sori on pinnules of the sterile part of the frond.

2. *B. TERNATUM* (Thumb.) Sw., Schrad. Jour. 1800<sup>2</sup>, 111, 1801; Hope, Jour. Bomb. nat. Hist. Soc., 15, 108, 1903; Panigrahi and Dixit, Proc. Nat. Inst. Sci. India, 35, 236, 1969.

Bas.: *Osmunda ternata* Thunb., Fl. Jap., 329, Pl. 32, 1784.

Syn.: *Scopteridium ternatum* (Thunb.) Lyon, Bot. Gaz., 40, 458, 1905.

Very rare; a single individual found near Kemkund, 3,000 m (Garhwal), growing on the exposed grass-land along the rivulet.

3. *B. LUNARIA* (L.) Sw., Schrad. Jour., 1800<sup>2</sup>, 110, 1801; Clarke, Trans. Linn. Soc. Lond., II, Bot. 1, 587, 1880; Bedd., Handb. Ferns Brit. India, 469, t. 293, 1883; Stewart, Bull. Torrey Bot. Cl., 72, 425, 1945; Mehra and Bir, Res. Bull. Panjab Univ. (N. S.), 15, 103, 1964.

Bas.: *Osmunda lunaria* Linn., Sp. Pl., 2, 1064, 1753.

It is a high altitude species distributed throughout the Himalayas but very rare. Reported from Aparwat, 3,600 m (Kashmir) growing in grassland. The plants are small and can be easily overlooked. Panigrahi and Dixit (1969) have reported two varieties from the area, viz., *B. lunaria* var. *lunaria* and *B. lunaria* var. *onondagense*.

4. *B. VIRGINIANUM* (L.) Sw., Schrad., Jour., 1800<sup>2</sup>, 111, 1801; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 588, 1880; Bedd., Handb. Ferns Brit. India, 471, 1883; Hope Jour. Bomb. nat. Hist. Soc., 15, 109, 1903; Stewart, Bull. Torrey Bot. Cl., 72, 425, 1945; Panigrahi and Dixit, Proc. Nat. Inst. Sci. India, 38, 245, 1969.

Bas.: *Osmunda virginiana* Linn., Sp. Pl. 2, 1064, 1753.

Very rare; collected from near Khati, enroute Pindari, 2,400 m (Almora), growing on a moist shaded wall in a thick forest. Hope (l.c.) has reported it from Western Himalayas. Schelpe (1954) has collected it from Kangra Himalayas. Panigrahi and Dixit (l.c.) have mentioned its occurrence in Dhamdar valley (Kumaon) and Deolsari (Garhwal).

OPHIOGLOSSUM Linn.

1. *O. VULGATUM* Linn., Sp. Pl., 2, 1062, 1753; Clarke, Trans. linn. Soc. Lond. II, Bot., 1, 586, 1880; Bedd., Handb. Ferns Brit. India, 464, 1883; Stewart, Bull. Torrey Bot. Cl., 425, 1945; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 103, 1964; Panigrahi and Dixit, Proc. Nat. Inst. Sci. India, 35, 255, 1969.

Common in the foothills and Punjab plains. Collected from near Hattoo, 3000 m (Simla) and Sat-tal, 1,200 m (Nainital).

Grows in the meadows overshadowed by grass, thus having chances of being overlooked. It occurs among *Saccharum* spp. along the streamlets near Chandigarh.

2. *O. PETIOLATUM* Hook., Exotic Flora, 1, 56, 1823; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 103, 1964.

Syn.: *Ophioglossum pedunculatum* Nakai in Bot. Mag. Tokyo, 39, 193, 1925.

Common in grass along water channels around Chandigarh, 350 m. According to Claussen (1938) *O. petiolatum* is very closely related to *O. reticulatum* and especially in India the two species seem somewhat to intergrade.

3. \**O. RETICULATUM* Linn., Sp. Pl. 2, 1063, 1753; Clausen, Mem. Torrey Bot. Cl., 19 (2), 130, 1938; Bedd., Handb. Ferns Brit. India, 465, t. 291, 1883; Mahabale, Bull. Bot. Surv. India, 4, 71, 1962; Wieffering, Blumea, 12, 327, 1964; Panigrahi and Dixit, Proc. Nat. Inst. Sci. India, 35, 259, 1969.

Panigrahi and Dixit (l.c.) have put the Mussoorie individuals under the form *dilatatum* (Miq.) Wieff. of the species.

4. *O. POLYPHYLLUM* A. Br. apud Seubert, Fl. Azor., 17, 1844; Panigrahi and Dixit, Proc. Nat. Inst. Sci. India, 35, 255, 1969.

Syn.: *O. atchisoni* (Clarke) d'Almeida, Jour. Indian Bot. Soc., 3, 63, f. 12-13, 1922; Clausen, Mem. Torrey Bot. Cl., 19 (2), 138, 1938; Mahabale, Bull. Bot. Surv. India, 4, 71, 1962.

*O. lusitanicum* Hope (non Linn.), Jour. Bomb. mat. Hist. Soc., 15, 106, 1903.

Reported from the foothills near Dehra Dun, 600 m (Mussoorie) and near Hoshiarpur, 300 m (Punjab). Also reported from Cherat, 2,700, (Simla).

## OSMUNDACEOUS SERIES

### Family Osmundaceae

#### *OSMUNDA* Linn.

1. *O. CLAYTONIANA* Linn., Sp. Pl., 2, 1066, 1753; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 582, 1880; Bedd., Handb. Ferns Brit. India, 449, t. 275, 1883; Stewart, Bull. Torrey Bot. Cl., 72, 424, 1945; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 104, 1964; Panigrahi and Dixit, Jour. Ind. Bot. Soc., 48, 90, 1969.

Very common at high altitudes. Collected from Liderwatt, 3,000m and Khilanmarg, 3,300 m (Kashmir), near Hattoo, 3,000, (Simla) and enroute Pindari, 3,300 m (Almora). It is observed that the species is restricted to middle and inner ranges only.

2. *O. REGALIS* Linn., Sp. Pl., 2, 1065, 1753; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 583, 1880; Bedd., Handb. Ferns Brit. India, 450, t. 276, 1883; Bir, Bull. Bot. Surv. India, 5, 155, 1963; Panigrahi and Dixit, Jour. Ind. Bot. Soc., 48, 95, 1969.

Collected from Chadwick-falls, 1,500 m (Simla), Chamoli, 1,200m (Garhwal) and Dhakuri, 2,100 m (Almora), growing along the forest margin on moist and shaded roadside.

3. \**O. JAPONICA* Thumb., Fl. Jap., 330, 1784; Tagawa, The Japanese Pterido. 34, t. 9, f. 51, 1959; Panigrahi and Dixit, Jour. Ind. Bot. Soc., 48, 97, 1969.

Panigrahi (l.c.) has reported it from Garhwal. Differs from *O. regalis* in having dimorphic fronds and fertile fronds appearing earlier in the season, usually between March and April.

## SCHIZAECEOUS SERIES

### Family Schizaeaceae

#### *LYGODIUM* Swartz

1. *L. FLEXUOSUM* (L.) Sw., Schrad. Jour., 1800<sup>2</sup>, 106 (pt.), 1801; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 584, 1880; Bedd., Handb. Ferns Brit. India, 457, t. 283, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 104, 1964.

Bas.: *Ophioglossum flexuosum* Linn., Sp. Pl. 2, 1063, 1753.

This is a low altitude fern found between 300-900 m, especially Ramban, 900 m, (Kashmir); Bhabar, 300-600 m (Nainital) and is also reported from Mussoorie, 1,200 m.

The species does not seem to have a continuous and uniform distribution in North Western Himalayas. Abundant in the foothills of Kumaon but westwards its occurrence is in the form of patches in particular localities.

2. *L. JAPONICUM* (Thumb.) Sw., Schrad. Jour., 1800<sup>2</sup>, 106, 1801; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 584, 1880; Bedd., Handb. Ferns Brit. India, 457, 1883; Stewart, Bull. Torrey Bot. Cl., 72, 424, 1945; Mehra and Bir, Res. Bull. Panjab Univ. (N. S.), 15, 105, 1964.

Bas.: *Ophioglossum japonicum* Thunb., Fl. Jap., 328, 1784.

Common at Chamoli, 900 m in the Garhwal hills where it climbs



the bushes or shrubs. Clarke (l.c.) and Beddome (l.c.) have reported its presence throughout the Himalayas but the present observations reveal that the distribution is very much localized to a few places.

3. *L. CIRCINATUM* (Burm.) Sw., Syn. Fill., 153, 1806; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1,583, 1880; Bedd., Handb. Ferns Brit. India, 455, 1883.

Bas.: *Ophioglossum circinatum* Burm., Fl. Ind. 228, 1768.

Collected from Tanakpur in the Bhabar forest at 300 m (Nainital). This is a new record for North Western Himalayas. Previously it has been reported from South India (Bedd., l.c.).

It forms big patches on the forest floor due to creeping nature of the rhizome. The bipartite palmate lobes with short primary petiole give a beautiful circinate look from a distance.

Family Marsileaceae

*MARSILEA* Linn.

1. *M. MINUTA* Linn., Mant., 308, 1771 (excluding  $\beta$ ); Stewart, Bull. Torrey Bot. Cl., 72, 425, 1945; Mehra and Dhir, Bull. Bot Surv. India, 10, 303, 1968.

It is a common fern of shallow waters. Frequently seen around Chandigarh 350 m, Khajjiar lake (Dalhousie), near Kullu, 1,200 m and in many small lakes and rice fields near Srinagar, 1,500 m, (Kashmir). Two races are reported in this species, a normal diploid sexual ( $n = 20$ ) and triploid ( $2n = 60$ ) which is sterile but reproduces vegetatively prolifically. The latter is by far more common.

## Family Adiantaceae

### *ADIANTUM* Linn.

1. *A. CAPILLUS-VENERIS* Linn., Sp. Pl., 2, 1096, 1753; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 453, 1880; Bedd., Handb. Ferns Brit. India 84, 1883; Ching, Ic. Fil., Sinicarum 5, Pl. 216, 1958; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 105, 1964.

A graceful shade-loving calciphilous plant, often forming large patches in dripping limestone niches. Extensively common throughout the Western Himalayas growing in diverse macro and micro climatic conditions. Shows a great polymorphy within the species, varying in size, degree of pinnation and depth of segmentation of pinnules. Smaller specimens have always been seen on well exposed rocks near water channels and are generally less fertile. The plants growing as lithophytes on shaded and moist walls are the largest and occur between 1,500-2,400 m.

Collected from Srinagar, 1,500 m and Pahlgam, 2,100 m (Kashmir); Dalhousie, 1,500 m; Kulu, 1,200 m; Chandigarh, 300 m; Kasauli, 1,800 m; Simla, 1,500 m; Mussoorie, 1,800 m; Chamoli, 1,200 m (Garhwal); Bhowali, 1,500 m and Khurpatal, 1,800 m (Nainital).

var. *wattii* Bedd., Handb. Ferns Brit. India, Suppl., 18, 1892.

Extremely common near Pangti, 2,400 m and Kanum, 3,000 m (Kalpa valley). Grows on shaded and humus rich walls along the streamlets at higher altitudes.

2. *A. INCISUM* Forssk., Fl. Aeg. Ar., 187, 1775; Bir and Verma, Res. Bull. Panjab Univ. (N.S.), 14, 193, Figs. 4-6, 1963; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 105, 1964.

Syn.: *Adiantum caudatum* Auctt. in Bedd., Ferns South. India, t. 2, 1863; Handb. Ferns Brit. India, 83, t. 44, 1883. Stewart, Bull. Torrey Bot. Cl., 72, 421, 1945.

One of the commonest species at lower altitudes. Collected from Jammu, 900 m and Rampur, 900 m (Kashmir); Kalka, 600 m;

Srinagar, 900 m (Garhwal); Loharkhet, 1,000 m (Almora) and Ranikhet, 1,200 m (Almora).

It prefers rather exposed rocks and always grows along the roadside on the margin of the forests. It thickly covers the wall on which it grows due to the rooting nature of the rachis tip on touching the ground, which character gives it the name 'walking fern'.

3. *A. LUNULATUM* Burm., Fl. Ind., 235, 1768; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 452, 1880; Bedd., Handb. Ferns Brit. India, 82, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 105, 1964.

Syn.: *Adiantum philippense* Linn., Sp. Pl., 2, 1094, 1753; Holtt., Fl. Malaya, II, 598, 1954; Ching, Ic. Fil. Sinicarum, 5, Pl. 214, 1958.

It is again a common fern of low altitudes. Recorded from Dalhousie, 1,200 m; Kasauli, 900 m; Dehra Dun, 900 m (Mussoorie); Nainital, 1,200 m; Loharkhet, 900 m and Jageshwar, 1,000 m (Kumaon).

It grows as a lithophyte on shaded walls where the conditions are a little humid.

It is an apomictic species occurring in two cytological races in the Western Himalayas, a triploid apomict ( $n = 90$ ) which is exceedingly common and relatively large and a diploid apomict ( $n = 60$ ) which is rather rare and small.

4. *A. EDGEWORTHII* Hook., Sp. Fil., ii, 14, t. 81B, 1851; Bedd., Handb. Ferns Brit. India, Suppl., 17, 1892.

Syn.: *Adiantum caudatum* var. *rhizophorum* Wall. in Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 453, 1880.

Collected from Balun, 1,500 m (Dalhousie); Kulu, 1,200 m; Bhowali, 1,500 m (Nainital). Also reported from Simla, 1,800 m and Mussoorie, 1,200 m.

Common as lithophyte on shaded walls in *Pinus roxburghii* for-

ests. At Dalhousie, it is seen growing near the bases of trees. This species also exhibits the hopping nature of the frond for the purposes of vegetative reproduction.

5. *A. PEDATUM* Linn., Sp. Pl., 2, 1095, 1753; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 453, 1880; Bedd., Handb. Ferns Brit. India, 86, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 241, 1900; Stewart, Bull. Torrey Bot. Cl., 72, 421, 1945; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 106, 1964.

This is a high altitude fern found near Phurkia, 3,300 m (Almora) and Hattoo, 3,000 m (Simla). Grows as lithophyte on the shaded walls along roadside where it is least exposed to the cold alpine winds.

6. *A. VENUSTUM* D. Don, Prod. Fl. Nepal., 17, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 453, 1880; Bedd., Handb. Ferns Brit. India, 86, t. 45, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 241, 1900; Mehra and Bir, Res. Bull. Panjab Univ. (N. S.), 15, 106, 1964.

Extremely common between 1,200-3,300 m. Collected from Amarnath, 3,300 m (Kashmir); Dalhousie, 1,800 m; Kulu, 1,200 m; Hattoo, 3,000 m (Simla); Hemkund, 3,000 m (Garhwal) and Nainital 2,100 m.

At lower altitudes, the fern prefers densely shaded and humus rich walls but in the alpine zone it grows on well exposed rocks. Caudex which is short-creeping is always deep-seated in the crevices.

#### Family Vittariaceae

#### *VITTARIA* J. Smith

1. *V. FLEXUOSA* Fée, 3me. Mem., 16, 1851-52; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 574, 1880; Bir, Res. Bull. Panjab Univ. (N.S.), 13, 22, 1962.

Syn.: *Vittaria lineata* sensu Bedd., Handb. Ferns Brit. India, 407, 1892;  
Hope, Jour. Bomb. nat. Hist. Soc., 15, 103, 1903

A common epiphyte near Khati, 2,550 m, enroute Pindari (Almora), hanging from moss-laden and densely shaded tree-trunks. The fronds are linear with a prominent midrib.

Family Cryptogrammeaceae

*ONYCHIUM* Kaulf.

1. *O. SILICULOSUM* (Desv.) C. Chr., Index Fil. 469, 1906; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 108, 1964.

Bas.: *Pteris siliculosum* Desv., Ges. Freunde Berlin Mag., 5, 324, 1811.

Syn.: *Onychium auratum* Kaulf., Enum., 144, 1824; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 458, 1880; Bedd., Handb. Ferns Brit. India, 96, t. 49, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 443, 1901.

Rare, reported from Thal, 1,200 m (Kumaon) and Rajpur, 900-1,200 m (Mussoorie).

2. *O. CONTIGUUM* Wall. ex Hope, Jour. Bomb. nat. Hist. Soc., 13, 444, 1901; Ching, Ic. Fil. Sinicarum, 4, Pl. 161, 1937; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 108, 1964.

It is one of the commonest ferns especially in the outer ranges of North Western Himalayas but has also been reported from the inner ranges such as Phalgam, 2,200 m (Kashmir); Hemkund, 2,100-2,700 m (Garhwal); Jageshwar, 1,800 m (Almora). In the outer Himalayas it is extremely common at Nainital, Mussoorie, Simla and Dalhousie between 1,800-2,400 m.

The species shows a good deal of variation in size, texture and scales at the base of stipe. The plants collected from Panjpulla, 1,800 m (Dalhousie) are 90-120 cm in length and 45-60 cm in breadth, herbaceous, dark green in colour with a thin, long, green stipe lacking scales. The population growing on drier

forest floor has 30-75 cm long and 30 cm broad fronds with crass herbaceous texture and light green in colour with a short stipe. The individuals growing as lithophytes on the shaded walls are smaller, i.e., 15-45 cm long and 20 cm broad with subcoriaceous texture and yellowish green in colour with the stipe having a few scales at the base.

The species also shows its adaptability to diverse habitats such as on the forest floor, and as lithophyte. Rarely, it has been observed growing as foot epiphyte (Nainital, 1,800 m), on the tree-trunks about three feet above the ground but the plants always remain small and sterile.

3. *O. LUCIDUM* (D. Don) Spr., Syst., 4, 66, 1827; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 108, 1964.

Bas.: *Leucostegia lucida* D. Don, Prod. Fl. Nepal., 14, 1825.

A fairly common species, found in Kulu valley, 1,200 m; Kalpa valley, 1,300 m and Pun nawala, 1,650 m (Almora). It grows on exposed humus rich forest floor along the water channels. It differs from *O. contiguum* in having brown stipe with a few scales, more coarsely cut lax frond and involucre being about 6 mm in length.

4. *O. PLUMOSUM* Ching, Lingnan Soc. Jour., 13, 499, 1934.

Rare, collected from Manali, 2,000 m (Kulu) growing along shaded and humus rich forest margin. New record for India.

5. \**O. JAPONICUM* (Thunb.) Kze., Bot. Zeit., 507, 1848; Bedd., Handb. Ferns Brit. India, 96, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 443, 1901; Mehra, Ferns Muss., 13, 1939; Schelpe, Amer. Fern Jour., 44, 52, 1954.

Reported from Dalhousie westwards between 1,500-2,700 m.

Not collected by the author.

6. *O. FRAGILE* Verma et Khullar, Nova Hedwigia, 9, 85, 1965.

Reported from Mussoorie hills, 2,100 m. The holotype in PAN.

*CRYPTOGRAMMA* R. Br. ex Richards

1. *C. CRISPA* (Linn.) R. Br. in Hook., Gen. Fil., t. 115B, 1842; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 459, 1880; Bedd., Handb. Ferns Brit. India, 98, t. 50, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 108, 1964.

Bas.: *Osmunda crispa* Linn., Sp. Pl., 2, 1067, 1753.

A common high altitude species collected from Khilanmarg, 3,600 m and Kolahoi glacier, 3,300 m (Kashmir); Hemkund, 3,300-3,600 m (Garhwal) and Pindari glacier, 3,300 m (Almora). It inhabits the moist and humus covered rocks or ridges in alpine conditions.

The fronds are dimorphic - the fertile frond is erect and stiff and the sterile frond is almost prostrate and leathery with broader pinnules.

2. *C. GRACILIS* (Michx.) Clute, Fern Bull., 14, 119, 1906.

Bas.: *Pteris gracilis* Michx., Fl. bor. Am., 2, 262, 1803.

Syn.: *Cryptogramma stelleri* (Gmel.) Prantl, Engl. Jahrb., 3, 413, 1882; Stewart, Bull. Torrey Bot. Cl., 72, 418, 1945.

*Pellaea gracilis* Hook., Sp. Fil. 2, 138, 1858; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 460, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 447, 1901.

Rare, collected from Sheshnag, 3,300 m (Kashmir); Pindari, 3,600 m (Almora), growing in moist, shady places on calcareous rocks in the alpine region.

This is a very delicate species with the lower pinnae always thin-membranaceous and sterile. Only the upper part of the frond is fertile and yellowish green in colour.

Family Sinopteridaceae

CHEILANTHES Swartz

1. *C. PERSICA* (Bory) Mett. in Kuhn, Fil. Afr., 73, 1868; Stewart, Bull. Torrey Bot. Cl., 72, 420, 1845.

Bas.: *Notholaena persica* Bory, Bel. Voy. Bot., 2, 23, 1833.

Syn.: *Cheilanthes szovitzii* Fisch. and Meyer, Bull. Soc. Mosc., 6, 260, 1833; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 454, 1880; Bedd., Handb. Ferns Brit. India, 89, 1883.

A common fern of Kashmir and Kulu valley growing between 1,200-2,100 m; generally occupies the dry and exposed stony walls with a little or no humus.

Fronds have small bead like pinnules and the Indusium is covered with a thick felt of hairs so that the whole surface appears to be matted.

2. *C. SUBVILLOSA* Hook., Sp. Fil., 2, 87, t. 98B, 1852; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 456, 1880; Handb. Ferns Brit. India, 93, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 108, 1964.

Common in Kulu valley and Simla hills growing as lithophyte on well exposed rocky walls where little humus is present. Collected from Urni, 1,500 m and Jhangi, 2,100 m (Kalpa valley).

3. *C. ALBOMARGINATA* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 456, t. 52, 1880; Bedd., Handb. Ferns Brit. India, 94, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 245, 1900; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 109, 1964.

Extremely common in North Western Himalayas from Kashmir to Kumaon between 1,200-2,700 m. The species is variable as regards size and shape of the frond. The small mature fronds are profusely covered with bicoloured scales and thick farina and the sori obliterating whole of the under surface of pinnules.



The large fronds have fewer scales and generally farina is absent and the sori are restricted to the margin only. Author has collected both the forms on the same rhizome but if separated, each may be confused to be a separate taxon.

4. *C. FARINOSA* (sensu Blanford in Simla nat. Hist. Soc. leaflet, 1886.)

Extremely common at low altitudes from the plains up to 1,500 m. Grows in varied environments, i.e., in the shaded and moist places, in shaded but drier places under the shrubs, and occasionally in quite exposed and dry conditions where little moisture and humus is present.

5. *C. DALHOUSIAE* Hook., Sp. Fil., 2, 80, t. 783, 1852; Hope, Jour. Bomb. nat. Hist. Soc., 13, 243, 1900; Mehra and Bir, Res. Bull. Panjab Univ., (N.S.), 15, 109, 1964.

Syn.: *Cheilanthes farinosa* Kaulf. var. *dalhousiae* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 457, t. 51, 1880; Bedd., Handb. Ferns Brit. India, 93, 1883.

A common species between 1,800-2,700 m especially Dalhousie, 2,100 m; Hattoo, 2,700 m (Simla); Badrinath and Hemkund, 2,200-2,700 m (Garhwal) and around Nainital, 1,800-2,400 m.

At lower altitudes, it is found in the dense forests on shaded and humus rich rocky walls. It prefers exposed rocky habitat at higher elevations where large fronds are observed hanging from the walls.

6. *C. ANCEPS* Blanford in Simla nat. Hist. Soc. 25/6, 1886; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 109, 1964.

Syn.: *Cheilanthes bullosa* Bedd., Ferns South. India, t. 192, 1863.

*C. farinosa* Kaulf. var. *anceps* Blanford in Jour. Asiatic Soc. Bengal, 57, 249, 1888.

*Aleuritopteris anceps* (Blanford) Panigrahi, Bull. Bot. Surv. India, 2, 321, 1960.

Common at Gwaldam, 1,500 m, Loharkhet, 1,500 m and Punnawala, 1,500 m (Almora) and Bhowali 1,300 m (Nainital). Also reported from Simla, 1,350-1,500 m and Mussoorie, 1,050-1,500 m. It grows on dry and exposed rocks with rhizomes fixed in the crevices. It grows at the upper altitudinal limits of *C. farinosa* but at higher elevations it is replaced by *C. albomarginata*.

var. *brevifrondis* Khullar, Amer. Fern. Jour., 66, 24, 1976.

Occurs between 1,060-1,800 m in Simla hills.

7. *C. DUBIA* Hope, Jour. Bomb. nat. Hist. Soc., 12, 528, 1899.

Syn.: *Aleuritopteris dubia* (Hope) Ching, Hongkong nat., 10, 200, 1941.

Collected from Katholag, 1,800 m (Dalhousie); Rajpur, 1,200 m (Mussoorie) and Khurpatal, 1,200 m (Nainital). The species seems to be rather rare, showing a restricted distribution in the outer ranges of the Himalayas.

8. *C. UFA* D. Don, Prod. Fl. Nepal., 16, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 457, 1880; Bedd., Handb. Ferns Brit. India (with suppl.), 94, 1892; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 109, 1964; Mehra and Dhir, Bull. Bot. Surv. India, 10, 304, 1968.

Syn.: *Aleuritopteris rufa* (D. Don) Ching, Hongkong nat., 10, 200, 1941.

This also is a low altitude species growing luxuriantly at 1,200 m. Common near Jandrighat, 1,500 m (Dalhousie); Sahsardhara, 1,000 m (Mussoorie); near Kapkot, 1,100 m (Almora) and Kaladhungi, 1,400 m (Nainital).

Grows on exposed limestone rocky slopes with the frond margins generally curled up. It is thickly covered with yellowish wolly hairs giving it a tomentose character.

9. *C. SUBRUFa* Baker, Kew Bull., 8, 1906.

Syn.: *Aleuritopteris subrufa* (Bak.) Ching, Hongkong nat., 10, 201, 1941.

A rare species; collected from Kalpa valley, growing lithophytically on exposed, dry rocks along the streamlets.

10. *C. DUTHIEI* Bak., Ann. Bot., 5, 210, 1891; Hope, Jour. Bomb. nat. Hist. Soc., 13, 242, 1900; Bedd., Handb. Ferns Brit. India (with suppl.), 20, 1892.

Syn.: *Aleuritopteris duthiei* (Bak.) Ching, Bull. Fan. Mem. Inst. Biol., ser. 2, 1, 271, 1949.

A rare fern in the region; collected from Hemkund area, 3,300-3,900 m growing on exposed rocks where it fixes its rhizome in the crevices. It is pertinent to note here that it has the cutting of *C. subvillosa* but it differs in having scales on the stipe. The sori are all around the edges of the pinnules and confluent in the specimens examined presently. The species belongs to Fée's section *Adiantopsis*.

(Duthie from Kauri pass, 3,600-3,900 m, sheet No. 5744 in DD).

11. \**C. PTERIDIOIDES* (Reich.) C. Chr., Ind. Fil., 178, 1905; Stewart, Bull. Torrey Bot. Cl., 72, 420, 1945; Pichi-Sermolli, Webbia, 23, 159-207, 1968.

Bas.: *Polypodium pteridioides* Reich., L. Syst. Pl. ed. Novis, 4, 424, 1780.

Syn.: *Cheilanthes fragrans* Webb. and Berth., Hist. nat. Canar., 32 (3), 452, 1847; Bedd., Handb. Ferns Brit. India, 88, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 242, 1900.

Reported from Jehlum valley and Kishtwar, 1,500-1,800 m (Kashmir) and Ravi valley, 1,500-2,100 m. (McDonell from Ravi valley, 1,500 m and Harsukh from Chamba, 2,100-2,400 m sheets in DD; McDonell from Bassu, 2,100 m and H. Collett from Cherat, 1,200 m, dated Aug., 1892 sheets in CAL).

12. *C. CHRYSOPHYLLA* Hook., Sp. Fil., 2, 113, 1852; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 109, 1964.

Syn.: *Cheilanthes argentea* var. *sulphurea* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 458, 1880.

*C. farinosa* Kaulf. var. *chrysophylla* Bedd., Handb. Ferns Brit. India, 93, 1883.

*Aleuritopteris farinosa* var. *chrysophylla* (Hook.) Panigrahi, Bull. Bot. Surv. India, 2, 312, 1960.

Very rare; only once collected by Bir (1963) from Shali peak (Simla), growing on exposed rocks.

13. *C. GRISEA* Blanford in Simla nat. Hist. Soc. Leaflet, 1886 and Jour. Asiatic Soc. Bengal, 58, 302, 1889; Hope, Jour. Bomb. nat. Hist. Soc., 13, 250-1900.

Syn.: *Cheilanthes farinosa* var. *grisea* Blanford, Jour. Asiatic Soc. Bengal, 57, 250-251, 1888; Bedd., Handb. Ferns Brit. India, Suppl. 21, 1892.

*C. farinosa* var. *tenera* Clarke and Baker, Jour. Linn. Soc., 24, 411, 1888.

*Aleuritopteris grisea* (Blanford) Panigr. Bull. Surv. India 2: 321. 1961.

Reported from around Hattoo, 2,500-2,800 m (Simla) and Mussoorie, 2,00 m. (Blanford from Narkandao-Baghi road, 2,550 m, dated 22.7.1885, Trotter from Narkanda and Bor from Keylong, sheets in DD; Blanford from Narkanda-Baghi road, 2,550 m, dated 22.7.1885 and Duthie from Kumaon, 2,100 m, dated 2.7.1886, sheet no. 6276 in CAL).

#### DORYOPTERIS J. Smith

1. *D. TAMBURII* (Hook.) C. Chr., Acta Horti Gotob., 1, 86, 1924.

Bas.: *Pellaea tamburii* Hook., Sp., 2, 134, t. 129A, 1885.

Syn.: *Cheilanthes argentea* (Gmel.) Kze., Linn., 23, 242, 1850; Bedd., Handb. Ferns Brit. India, 95, 1883.

*Aleuritopteris tamburii* (Hook.) Ching, Hongkong Nat., 10, 201, 1941.

Very rare; collected from Kalpa valley (1,200 m) growing on ex-

posed rocks in the dry arid zone. Reported for the first time from the Western Himalayas. Beddome (l.c.) recorded it from Khasia and Jaintia hills.

PELLAEA Link

1. *P. NITIDULA* (Hook.) Bak., Syn., 149, 1867; Bedd., Handb. Ferns Brit. India, 101, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 460, 1880; Mehra and Dhir, Bull. Bot. Surv. India, 10, 304, 1968.

Bas.: *Cheilanthes nitidula* Hook., Sp. 2, 42, 1852.

Plentiful near Kulu, 1,200 m, Jandrighat, 1,500-1,800 m and near Chamba, 1,200-1,500 m (Dalhousie) but scarce eastwards. Found near Joshimath, 1,800 m (Garhwal) and Loharkhet, 1,200 m (Almora).

The species grows generally on dry exposed rocks along with *Cheilanthes*. Pubescent nature of stipe and rachis enables the species to grow in this habitat.

2. \**P. HASTATA* (Thunb.) Prantl, Engl. Jahrb., 3, 418, 1882; Stewart, Bull. Torrey Bot. Cl., 72, 419, 1945.

Bas.: *Pteris hastata* Thunb., Prod. Fl. Cap., 192, 1800.

Syn.: *Pellaea calamitanos* (Sw.) Lind., Fil. Sp. 61, 1841; Clarke, Trans. Linn. Soc. Lond. II, Bot., 1, 461, 1880; Bedd., Handb. Ferns Brit. India, 104, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 448, 1901.

Reported from Tikri around Simla, near Mussoorie, 1,200 m and below Almora, 1,200 m. Not observed by the author. (Duthie in Ganges valley, 12-1,500 m, Reid from below Almora (Khairna), 1,200-1,500 m dated Oct., 1884, sheet no. 3677 in DD; Strachey from Kumaon in 1848, Gamble from near Bara, Jaunsar, 1,200-2,400 m, dated Nov., 1894, sheet no. 15163 in CAL).

NOTHOLAENA R. Br.

1. *N. MARANTAE* (L.) Desv., Jour. de Bot., Appl. 1, 92, 1813; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 567, 1880; Bedd., Handb. Ferns Brit. India, 383, t. 213, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 110, 1964.

Bas.: *Acrostichum marantae* Linn., Sp. Pl., 2, 1071, 1753.

A rare species of Alpine Himalayas showing discontinuous distribution. Collected from near Hemkund, 2,700-3,300 m growing lithophytically on the exposed rocks in arid habitats. Sometimes it is also seen growing as an epiphyte on the thickly moss-laden tree trunks. Rhizome is thickly covered with soft silky ferruginous scales, upper surface of frond is glabrous but thick ferruginous scales are present on the under surface. Sori form a very prominent border. Pichi-Sermolli (1963), while working on the geobotanic studies of the species, thought it to be a relic of fairly ancient time; probably of tertiary period.

2. \**N. VELLEA* (Ait.) Desv., Jour. de Bot., Appl., 1, 93, 1813; Stewart, Bull. Torrey Bot. Cl., 72, 419, 1945.

Bas.: *Acrostichum vellea* Ait., Hort. Kew, 3, 475, 1789.

Reported from Chamba. Not observed by the author. (McDonnell from below Pokhri, Ravi valley, 1,050 m, dated 1892, sheet in CAL; Gammie and Marten from Chamba, 900-1,050 m, sheets in DD).

Family Gymnogrammaceae

ANOGRAMMA Link

1. *A. LEPTOPHYLLA* (L.) Link, Fil. Sp., 137, 1841; Mehra and Dhir, Bull. Bot. Surv. India, 10, 304, 1968.

Bas.: *Polypodium leptophylla* L., Sp. Pl., 2, 1092, 1753.

Syn.: *Gymnogramma leptophylla* Desv., Bend. Mag., 5, 305, 1811; Bedd., Handb. Ferns Brit. India, 382, 1883.

A common lithophyte, growing in densely shaded gorges, generally associated with *Rhodobryum* sp. Collected from Dalhousie, 2,000 m; Simla, 2,100 m; Mussoorie, 2,000 m and Nainital, 2,000 m. Not seen in Kashmir valley and in the inner Himalayan ranges.

#### *GYMNOPTERIS* Bernhardtii

1. *G. VESTITA* (Wall. ex Moore) Und., Bull. Torrey Bot. Cl., 29, 627, 1902; Mehra and Dhir, Bull. Bot. Surv. India, 10, 304, 1968.

Bas.: *Syngramma vestita* Moore, Ind. Fil., 60, 1857; Bedd., Handb. Ferns Brit. India, 386, t. 223, 1883.

Plentiful from Mussoorie westwards between 1,500-2,400 m. Collected from Panjpulla, 1,500 m (Dalhousie); near Simla, 2,100 m and Jabarkhet, 2,400 m (Mussoorie). It commonly grows on exposed ridges and stony walls. Sometimes, it is seen on moist shaded walls also.

Rachis and under-surface of the frond is thickly covered with woolly hairs, silvery white when the fronds are young, turning brown at maturity. This character is responsible for its common name 'mouse ear fern'.

#### *CONIOGRAMME* Fée

1. *C. FRAXINEA* (D. Don) Diels, Nat. Pfl., 1<sup>4</sup>, 262, 1899. var. *DENTICULATO-SERRATA* Hieron. Hedwigia, 57, 298, 1916.

A common ravine fern growing along the banks in moist habitats. Reported from near Dalhousie, 1,200-1,800 m, Chadwick falls, 1,500 m (Simla); around Mussoorie, 1,500-1,800 m and near Nainital, 1,500 m.

var. *serrulata* Fée, Gen. 167, t. 14B, f. 2, 1830-51.

Reported from Simla, 1,500-1,800 m.

2. *C. CAUDATA* (Wall. ex Ettingsh) Ching, in C. Chr., Ind. Fil., Suppl., III, 56, 1934; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 111, 1964.

Bas.: *Grammitis caudata* Wall. ex Ettingsh, Farnkr., 57, t. 37, f. 7, t. 38, f. 13, 1865.

This is a fairly common species between 1,500-2,400 m altitude. Collected from Churah forest, 1,800 m (Dalhousie); around Simla, 1,800 m and near Khati, 2,400 m (Almora). Always prefers moist, shaded and humus rich forest-borders along the streams where the diurnal fluctuations are not well marked. Pubescent nature of the pinnae with caudatae apex are the distinguishing characters.

3. *C. AFFINIS* Hieron., Hedwigia, 57, 297, 1916; Schelpe, Amer. Fern Jour., 44, 58, 1954; Mehra and Dhir, Bull. Bot. Surv. India, 10, 304, 1968.

Collected from Panjputia, 1,800 m (Dalhousie). Schelpe (l.c.) reported it from Kangra valley.

4. *C. INTERMEDIA* Hieron., Hedwigia, 57, 301, 1916; Ching, Ic. Fil. Sinica., 3. Pl. 143, 1935 (Description only); Mehra and Dhir, Bull. Bot. Surv. India, 10, 304, 1968.

Common at higher altitudes near Pahlgam, 2,400 m (Kashmir); Dainkund, 2,700 m (Dalhousie) growing on the moist and shaded forest floor.

var. *glabra* Ching, Ic. Fil. Sinica., 3, Pl. 143, 1935.

Common in Kalatop forest, 2,400 m (Dalhousie); near Theog,



2,000 m (Simla) and near Cheena Peak, 2,100 m (Nainital), grow in on shaded, humus rich forest floor.

5. *C. INDICA* Fée, 10<sup>me</sup> Mem., 22, 1865; Hieron., Hedwigia, 57, 299, 1916; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 111, 1964.

Common in 'Valley of Flowers', Hemkund, 2,700-3,300 m and en-route Badrinath, 2,500 m (Garhwal). Grows under the shade of rocks and bushes and sometimes in open places in the alpine region. Also reported from Simla (Bir, 1963).

Family Parkeriaceae

*CERATOPTERIS* Brongniart

1. *C. THALICTROIDES* (Linn.) Brongn., Bull. Soc. Philom., 186c tab., 1821; Clarke, Trans. Linn. Soc. Lond. II, Bot., 1, 471, 1880; Bedd., Handb. Ferns Brit. India, 123, t. 63, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 458, 1901; Nair, Bull. Bot. Surv. India, 11, 186, 1969.

Bas.: *Acrostichum thalictroides* Linn., Sp. Pl., 1070, 1753.

Syn.: *Ceratopteris siliquosa* (L.) Copel., Phil. Jour. Sci. 56, 107, 1935; Ito in Hara, Fl. East Himalayas, 468, 1968.

Reported from Chamba and Kangra and also in Nainital area growing in rice fields. Collected from near Palampur, 900 m and near Dheramsala, 900 m (Dalhousie) growing near a spring. (Hope from Dehra Dun, 570 m, dated 14.12.1886, Champion from Haldwani and Nainital, sheets in DD; Clarke from Chamba, 900 m, dated 15.10.1874, sheet no. 23676, Mackinnon from Markanda swamp, Dehra Dun, dated 23.12.1898, Camble from Jaunsar, 500 m, dated 1892, sheet no. 25050 in CAL).

Family Pteridaceae

*PTERIS* Linn.

1. *P. STENOPHYLLA* Wall. *ex* Hook and Grev., Ic. Fil., t. 130, 1829; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 112, 1964.

Syn.: *Pteris pellucida* Presl var. *stenophylla* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 463, 1880; Bedd., Handb. Ferns Brit. India, 107, t. 56, 1883.

Collected from Kalpa valley, 1,000 m (Simla); Mossy falls, 1,500 m (Mussoorie) and Nainital, 1,600 m, growing on the shaded banks of streamlets.

2. *P. DACTYLINA* Hook., Sp. Fil., 2, 160, 1858; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 463, 1880; Bedd., Handb. Ferns Brit. India, 107, t. 56, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 451, 1901.

It is a high altitude fern observed near Dwali, 2,700 m (Almora) and Lariakanta, 2,400 m (Nainital), growing in moist, shaded and humus rich places along roadsides.

3. *P. VITTATA* Linn., Sp. Pl., 1074, 1753; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 112, 1964.

Syn.: *Pteris longifolia* Auctt. *guoad. pl. asiat*; Bedd., Ferns South. India, t. 33, 1863 and Handb. Ferns Brit. India, 106, t. 55, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 461, 1880.

*Pycnodoria vittata* (L.) Small, Ferns SE. States, 102 cum. tab., 468, 1938.

This is an extremely common low level species recorded from Ramban, 600 m (Kashmir); Khajjiar enroute Chamba, 1,200 m (Dalhousie); Glen, 1,500 m (Simla); Rampur, 600 m (Kalpa valley); Rajpur, 900 m (Mussoorie); Chamoli, 1,500 m (Garhwal); near Loharkhet, 1,500 m (Almora) and Kaladhungi, 300 m and Sat-tal, 1,650 m (Nainital).

Grows usually on dry and exposed slopes on gravelly soil but occasionally observed growing in very moist and densely shaded places near Dogaon, 600 m (Nainital) when the fronds attain the length of up to 1.2 m and 0.3-0.45 m in breadth. The Sat-tal plants are small with the terminal pinna as long as the rest of the frond.

4. *P. CRETICA* Linn., Mant., 130, 1767; Clarke, Trans. Linn. Soc Lond., II, Bot., 1, 462, 1880; Bedd., Handb. Ferns Brit. India, 106, 1883.

Syn.: *Pyenodoria cretica* (L.) Small, Ferns Florida 91 cum tab., 1932.

This is very common at Nainital and Mussoorie but its frequency decreases westwards so that it is rare in Kashmir valley. Collected from Pahlgam, 2,200 m (Kashmir); Manali, 1,800 m; around Dalhousie, 2,400 m; Theog, 2,200 m (Simla); Jhangi, 2,400 m (Kalpa valley); around Mussoorie, 1,800-2,400 m and Nainital, 2,100 m.

It inhabits the shaded and moist slopes forming big patches, occasionally covering vast areas. It shows considerable variation in length and breadth of the sterile and fertile pinnules. Generally the fertile pinnules are narrower and longer than the sterile pinnules, but occasionally these are of the same size. The margins of sterile pinnules are minutely serrate but in the Simla plants these serrations are as deep as 2 mm with yellowish-white stiff margin. This variation is considered to be environmental because these plants were growing in rather drier but shaded places. Thus to combat with dryness, these individuals have developed this character along with coriaceous texture.

The species occurs in two forms, a diploid apomict and a triploid apomict with 'n' = 58 and 87 respectively.

5. *P. SUBQUINATA* Wall. ex Hope in Jour. Bomb. nat. Hist. Soc., 13, 453, t. 17, 1901; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 113, 1964.

It is collected from Bageshwar, 900 m (Almora) from the same place from where Beddome (1892), Hope (1899) and Strachey (1906) have mentioned. The Western limit of its distribution apparently seems to be restricted to Kumaon hills.

6. *P. QUADRIAURITA* Retz. in Obs. Bot., 6, 38, 1791 (sensu lato); Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 465, 1880 (pro parte); Bedd., Handb. Ferns Brit. India, 110, 1883.

The species is common in the North Western Himalayas except Kashmir valley. Collected from Dalhousie, 2,000 m; Manali, 2,100 m; Simla, 1,800 m; Jabarkhet, 2,400 m; Camel's back, 1,800 m (Mussoorie); Snow view, 2,100 m; Cheena Peak, 2,400 m (Nainital).

The present observations reveal that it is restricted to the outer Himalayan ranges only. It inhabits the moist, shaded and humus rich forest edges, along roadside. Sometimes, it has been seen growing as a lithophyte on shaded walls. At Dalhousie, a few plants have been observed growing in a nallah on calcareous gravelly soil.

Shows polymorphicity as regards its size, pinnation and presence or absence of setae on the upper surface along the midrib. The large sized individuals collected from Bathri khud, 1,800 m (Dalhousie) have fronds 1.2-1.5 m long and 0.15-0.3 m broad. The lowest 2-3 pairs of pinnae are bipartite with the lowest pair further divided and the pinnules distantly placed. The setae are present on the upper surface along costae.

7. *P. ASPERICAULIS* Wall. ex Agardh, Rec. Spec. Ge. Pterid, 22, 1839; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 113, 1964.

Syn.: *Pteris quadriaurita* Retz. var. *aspericaulis* Bedd., Handb. Ferns Brit. India, 111, 1883.

Collected from Gobindghat, 1,800 m (Garhwal) and Gwaldam, 1,800 m (Almora) growing on the forest floor in moist, shaded and humus rich places. Schelpe (1954) reported it from Kangra valley.

8. *P. EXCELSA* Gaud., Freye. Voy. Bot., 338, 1829; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 467, 1880; Bedd., Handb. Ferns Brit. India, 114, 1883.

The species is recorded from Panjpara, 1,800 m (Dalhousie); Khati, 2,400 m (Almora) and Snow view, 2,100 m (Nainital). Not observed in Kashmir valley. Hope vide Stewart (1945) states that a sterile specimen of Gammie from Rattan pir referred to *P. quadriaurita* might be a sterile specimen of *P. excelsa*. But Stewart himself writes that the Kashmir record is not reliable. Hence, it seems that the Western limit of this species is restricted to Dalhousie hills where it is very rare.

9. *P. BIAURITA* Linn., Sp. Pl., 2, 1076, 1753; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 469, 1880.

Syn.: *Campteria biaurita* Hook., Gen. Fil., t. 65A, 1841; Bedd., Handb. Ferns Brit. India, 116, 1883.

The only record from Western Himalayas is from near Loharkhet, 1,500 m (Almora) and Chamoli, 900 m (Garhwal). Beddome (l.c.) mentioned its presence throughout Northern India but Clarke (l.c.) and Hope (1900) restricted its distribution to the Garhwal and Kumaon hills.

Prefers the exposed sunny slopes along the roadside where humidity is sufficient.

10. *P. WALLICHIANA* Ag., Rec. Sp. Gen. Pterid., 69, 1839; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 469, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 456, 1901.

Syn.: *Campteria wallichiana* Moore, Ind. Fil., 221, 1861; Bedd., Handb. Ferns Brit. India, 118, 1883.

Fairly common in Western Himalayas. Collected from Bathri, 1,200 m (Dalhousie); Manali, 2,100 m; Gobindghat, 1,800 m (Garhwal), Dhakuri, 1,500-2,400 m and Gwaldam, 1,800 m (Almora), growing on forest floor and occasionally forming big colonies covering the whole hillside.

HYMENOPHYLLACEOUS SERIES

Family Hymenophyllaceae

*MECODIUM* Presl

1. *M. EXSERTUM* (Wall. ex Hook.) Copel., Phil. Jour. Sci., 69, 23, 1938; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 115, 1964.

Bas.: *Hymenophyllum exsertum* Wall. ex Hook., Sp. Fil., 1, 109, 1844; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 436, 1880; Bedd., Handb. Ferns Brit. India, 30, t. 16, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 25, 1900.

Collected from Panj-pulla, 1,800 m (Dalhousie) and Dwali, 2,400 m (Almora). Previously, it was reported from Kumaon hills only. From Dalhousie, a small patch was collected growing along with mosses on tree-trunks in the water-falls.

2. *M. JAVANICUM* (Spr.) Copel., Phil. Jour. Sci., 67, 20, 1938; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 115, 1964.

Bas.: *Hymenophyllum javanicum* Spr., Syst. Veg., 4, 132, 1827; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 437, 1880; Bedd., Handb. Ferns Brit. India, 32, 1883.

Not common; collected from around Khati, 1800 m, growing on moist rocks in densely shaded forests.

3. \**M. POLYANTHOS* (Sw.) Copel., Phil. Jour. Sci., 67, 19, 1938; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 115, 1964.

Bas.: *Trichomanes polyanthos* Sw., Prod. Fil. Ind. Oce., 137, 1788.

Syn.: *Hymenophyllum polyanthos* Sw., Schrad. Jour. Bot., 1800<sup>2</sup>, 102, 1801; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 437, 1880; Bedd., Handb. Ferns Brit. India, Suppl., 30, 1892; Hope, Jour. Bomb. nat. Hist. Soc., 13, 25, 1900; Sledge, Jour. Linn. Soc. (Bot.), 60, 363, 293, 1968.

Not common, reported from Dwali, 2,400-2,700 m and in Pinder Gorge, 2,100-2,700 m (Almora). Not seen by the author.

VANDENBOSCHIA Copeland

1. \**V. PYXIDIFERA* (L.) Copel., Phil. Jour. Sci., 67, 1938; 1753; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 440, 1180; Bedd., Handb. Ferns Brit. India, Suppl., 42, 1892; Hope, Jour. Bomb. nat. Hist. Soc. 15, 26, 1900.

Not common. Hope (l.c.) found it in Pinder Gorge, 2,400 m (Almora).

*DIDYMOGLOSSUM* Desv.

1. *D. INSIGNE* v.d. B., Ned. Kr. Arch., 5<sup>3</sup>, 143, 1863; Bir, Bull. Bot. Surv. India, 5, 156, Figs. 7-11, 1963.

Syn.: *Trichomanes bipunctatum* Poir. var. *insigne* (v.d. B.) Bedd., Handb. Ferns Brit. India, 42, 1883.

*T. insigne* (v.d. B.) Bedd., Ferns Brit. India, 284, 1868.

Commonly met with in Panj-pulla falls, 1,800 m (Dalhousie); Chadwick-falls, 1,500 m (Simla); Mossy-falls, 1,500 m (Mussoorie) and near Kilbri, 1,800 m (Nainital), growing on moist, shaded rocks along the streams and sometimes grows epiphytically on moss-laiden tree-trunks.

Family Salviniaceae

*SALVINIA* Adanson

1. *S. NATANS* (L.) All., Fl. Pedem., 2, 289, 1785; Stewart, Bull. Torrey Bot. Cl., 72, 424, 1945.

Bas.: *Marsilea natans* Linn., Sp. Pl., 2, 1099, 1753.

Restricted to Kashmir valley only. Very common in Dal lake, 1,600 m, Srinagar and other small lakes and canals of the valley between 1,500 - 1,800 m.

2. *S. AURICULATA* Aublet, Hist. Pl. Guian., 2, 969, t. 367, 1775; Mehra and Dhir, Bull. Bot. Surv. India, 10, 304, 1968.

Reported from near Kulu, 1,200 m and Khajjiar lake, 1,800 m (Dalhousie). This is an introduced species which has gone wild in certain parts of India.

#### AZOLLA Lamarck

1. *A. PINNATA* R. Br., Prod. Fl. N. Holl., 167, 1810; Strachey, Cat. Plants of Kumaon, 252, 1906.

var. *imbricata* (Roxb.) Bonap., Notes Pterid., 7, 130, 1918; Sweet and Hills, Am. Fern Jour., 61, 7, 1971.

Collected from near Chandigarh, 300 m, floating on the surface of the water and generally admixed with *Marsilea minuta*.

#### Family Dennstaedtiaceae

#### DENNSTAEDTIA Bernh.

1. *D. APPENDICULATA* (Wall. ex Hook.) J. Smith, Hist. Fil., 265, 1875; Bedd., Handb. Ferns Brit. India, 26, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 116, 1964.

Bas.: *Dicksonia appendiculata* Wall. ex Hook., Sp. Fil. 1, 79, t. 27C, 1844; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 436, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 28, 1900.

Collected from enroute Badrinath, 1,500 m (Garhwal) and along Khati-Dwali road, 2,400-3,000 m (Almora).

Extremely common growing on exposed but moist and humus rich forest floor along roadside forming big patches covering large areas.



2. *D. SCABRA* (Wall. ex Hook.) Moore, Ind., 307, 1861; Bedd., Handb. Ferns Brit. India, 24, t. 12, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 116, 1964.

Bas.: *Dicksonia scabra* Wall. ex Hook., Sp. Fil., 1, 80 t. 28B, 1844; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 436, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 28, 1900.

Collected from Chadwick-falls, 1,500 m (Simla), and enroute Hem Kund, 1,800 m (Garhwal), growing on shaded and moist forest floor near the water-falls. Hope (l.c.) reported it from Nainital.

#### MICROLEPIA Presl

1. \**M. WILFORDII* Moore, Ind. Fil., 299, 1861; Stewart, Bull. Torrey Bot. Cl., 72, 413, 1945.

Syn.: *Davallia wilfordii* Bak., Syn. Fil., 98, 1867; Hope, Jour. Bomb. nat. Hist. Soc., 13, 33, 1900.

Rare; Stewart (l.c.) collected it from Boniar nallah near Rampur, 1,300 m (Kashmir), growing in a wet place. (Stewart from Rampur, Jehlum valley, 1,300 m, dated July, 1936, sheet no. 15521 in DD).

2. \**M. PLATYPHYLLA* (D. Don) J. Smith, Jour. Bot., 1, 427, 1842; Bedd., Ferns South India, t. 13, 1853 and Handb. Ferns Brit. India, 66, t. 33, 1883.

Bas.: *Davallia platyphylla* D. Don, Prod. Fl. Nepal., 10, 1825; Clarke, Trans. Linn. Soc. Lon., II, Bot., 1, 446, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 34, 1900.

Hope (l.c.) reported it from near Mussoorie, 1,200 m. Not observed by the author. (Mackinnon from near Mussoorie, sheet in DD; Mackinnon from Garhwal, dated May, 1879, sheet in CAL).

3. \*M. *HIRTA* (Kaulf.) Pr., Tent Pterid., 125, 1836.

Bas.: *Davallia hirta* Kaulf., Enum. 223, 1824; Hope, Jour. Bomb. nat. Hist. Soc., 13, 25, 1900.

Syn.: *Microlepia speluncae* (L.) Moore var. *hirta* Bedd., Handb. Ferns Brit. India, 68, 1883.

*Microlepia villosa* (D. Don) Ching in Ching et Wang, Acta Phytotax. Sin., 8, 139, 1959.

Reported from Garhwal and Kumaon hills between 800-1,500 m. (Inayat from Garhwal, dated 14.6.1902, sheet no. 26035 in DD; Strachey from Ramganga river, 800 m, dated 1848, Mackinnon from Garhwal, 1,500 m, dated 15.4.1881, sheets in CAL).

Family Hypolepidaceae

*PTERIDIUM* Scopoli

1. *P. AQUILINUM* (L.) Kuhn *ex* Decken, Reisen in Ost. Afrika, 3, 11, 1879; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 118, 1964.

Bas.: *Pteris aquilina* Linn. Sp. Pl., 2, 1075, 1753; Bedd., Handb. Ferns Brit. India, 115, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 468, 1880.

A common thicket forming species of Western Himalayas. Met near Pahlgam, 2,200 m (Kashmir); Banikhet, 1,500 m and Khajjiar, 1,800 m (Dalhousie); Kalpa valley, 900-2,400 m (Simla); Badrinath, 2,100 m and Hemkund, 1,800-2,700 m (Garhwal) and near Cheena peak and Laria-kanta, 2,400 m (Nainital), growing on the forest floor in exposed situations.

According to Clarke (l.c.) all the North Indian material belongs to the var. *lanuginosa*, with ultimate segments approximate, oblong, yellow-hairy beneath. But even in this variety, variation in respect of the division of lowermost pinnae is observed.

*HYPOLEPIS* Bernh.

1. *H. PUNCTATA* (Thunb.) Mett., Kuhn, Fil. Afr., 120, 1869; Bedd., Handb. Ferns Brit. India, Suppl., 19, 1892; Mehra and Bir, Res. Bull. Panjab Univ., (N.S.), 15, 118, 1964.

Bas.: *Polypodium punctatum* Thunb., Fl. Jap., 337, 1784.

Syn.: *Phegopteris punctata* Mett., 1864; Bedd., Handb. Ferns Brit. India, 295, 1883.

*Polypodium rugulosum* sensu Bedd., Ferns South. India, t. 170, 1863; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 546, 1880 (non *P. rugulosum* Labill, 1806).

Common in the area; reported from Bathri, 1,200 m (Dalhousie); Kulu, 1,200 m; Luri, 900 m (Kalpa valley); Chamoli, 1,200 m (Garhwal); Bhimtal, 900 m (Nainital).

Due to creeping nature of the rhizome, it covers large areas in exposed, xerophytic conditions on the slopes by the roadside along the forest margin. Stipe and rachis viscous-pubescent.

Family Lindsayaceae

*LINDSAYA* Dryander

1. *L. CULTRATA* (Willd.) Sw., Syn. Fil., 119, 1806; Bedd., Handb. Ferns Brit. India, 72, t. 36, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 450, 1880.

Bas.: *Adiantum cultratum* Willd., Phytogra., 14, t. 10, f. 2, 1794.

A new report for the area under investigation. Collected from Bharari, 900 m (Almora). It is very common in the Eastern Himalayas.

The present collections belong to the var. 2 of Clarke, growing in humus rich soil in shaded and damp places along streamlets, with herbaceous pinnae spreading horizontally.

SPHENOMERIS Maxon

1. *S. CHINENSIS* (L.) Maxon, Wash. Acad. Sci. Jour., 3, 144, 1913; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 119, 1964.

Bas.: *Trichomanes chinensis* Linn., Sp. Pl., 2, 1099, 1753.

Syn.: *Davallia chinensis* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 449, 1880.

*Stenoloma chinensis* (Linn.) Bedd., Handb. Ferns Brit. India, 70, t. 34, 1883.

Very common near Chamoli, 1,200 m (Garhwal). Also reported from Simla by Hope (1901) and Bir (1963) but has never been recorded westward of Simla.

It inhabits moist, shaded and calcareous grevelly walls along roadside.

Family Davalliaceae

ARAIOSTEGIA Copel.

1. *A. PSEUDOCYSTOPTERIS* (Kze.) Copel., Phil. Jour. Sci., 34, 241, 1927; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 119, 1964.

Bas.: *Leucostegia pseudocystopteris* Kze., Bot. Zeit., 68, 1850; Bedd., Handb. Ferns Brit. India, 54, 1883.

Syn.: *Davallia pulchra* var. *pseudocystopteris* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 444, 1880.

One of the commonest epiphytes from Dalhousie eastwards. Collected from Dalhousie, 1,500-2,400 m; Kulu, 1,800 m; Simla, 1,800 m; Mussoorie, 1,500-2,400 m; Gwaldam, 1,500 m (Almora) and Nainital, 1,500-2,600 m, growing on shaded and humus rich rocks associated with *Polypodium microrrhizoma* and *Lepisorus* spp.

Frequently seen as epiphyte on oak tree-trunks but occasionally it has been observed on the coniferous trees also.

2. *A. PULCHRA* (D. Don) Copel., Phil. Jour. Sci., 34, 241, 1927; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 119, 1964.

Bas.: *Davallia pulchra* D. Don, Prod. Fl. Nepal., 11, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 443, 1880.

Syn.: *Leucostegia pulchra* J. Smith, Bedd., Handb. Ferns Brit. India, 52, t. 25, 1883.

Presently reported from Gobind-ghat, 2,300 m (Garhwal). Beddome (l.c.) reported it from Kulu, Simla and Kashmir. Schelpe (1954) recorded it from Kangra Himalayas.

Grows as epiphyte and occasionally on moist, shaded and humus rich rocks along the river. It has long creeping rhizome, clothed with adpressed scales; frond lax, herbaceous, rather placid; sori prominent.

3. *A. DELAVAYI* (Bedd. ex Clarke et Bak.) Ching in Chien et Chun, Fl. Reipubl. Pop. Sin., 2, 289, 1959.

Bas.: *Davallia delavayi* Bedd. in Clarke et Bak., Jour. Linn. Soc., 24, 410, 1888.

Syn.: *Davallia beddomei* Hope, Jour. Bomb. nat. Hist. Soc., 12, 527, 1899.

This is a high altitufe species; met near Narkanda, 2,700 m (Simla); enroute Hemkund, 2,700 m (Garhwal) and near Dhakuri, 3,000 m (Almora). The species seems to be endemic to Western Himalayas.

Commonly grows as epiphyte on moss-laiden tree-trunks in moist and dense forests. Sometimes observed as lithophyte also when it covers large areas with the help of creeping rhizome.

4. *☆A. CLARKEI* (Bak.) Copel., Phil. Jour. Sci., 34, 241, 1927; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 120, 1964.

Bas.: *Davallia clarkei* Baker in Hook. and Bak., Syn. Fil., 91, 1874; Hope, Jour. Bomb. nat. Hist. Soc., 13, 30, 1900.

Syn.: *Leucostegia hookeri* Bedd., Handb. Ferns Brit. India, 52, 1883.

Hope (l.c.) reported it from Chamba, 3,100 m, on Hattoo-Baghi road, 2,700-3,300 m (Simla). Not observed by the author.

#### LEUCOSTEGIA Presl

1. *L. IMMERSA* Wall. ex Presl, Tent. Pterid., 95, t. 4, f. 11, 1836; Bedd., Handb. Ferns Brit. India, 51 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 120, 1964.

Not very common; reported from near Simla, 1,500 m; Mossy-falls, 1,500 m (Mussoorie); Loharkhet, 1,800 m (Almora); Kaladhungi, 1,500 m (Nainital).

Generally inhabits the exposed rocky or masonry walls along the roadside, having its rhizome burried either in the crevices or under the humus cover. Rarely seen growing on sand stone rocks.

#### DAVALLODES Copeland

1. \**D. MEMBRANULOSUM* (Wall. ex Hook.) Copel., Phil. Jour. Sci., 34, 245, 1927; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 120, 1964.

Bas.: *Davallia membranulosa* Wall. ex Hook., Sp. Fil. 1, 159, t. 53A, 1844; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 442, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 29, 1900.

Syn.: *Leucostegia membranulosa* J. Smith, Hist. Fil., 84, 1875; Bedd., Handb. Ferns Brit. India, 50, 1883.

Reported from Mohargari pass in Kumaon hills, 1,950 m altitude. Not observed by the author. (Hope from below Nainital, 500-

1,500 m dated 1848, sheet no. 1361, Duthie from near Askot, dated 14.8.1886, Inayat from Sarju valley, dated 31.7.1900, sheet no 25080, Mackinnon from Garhwal, 2,400 m, dated 12.9.1903, sheets in CAL).

Family Oleandraceae

*OLEANDRA* Cavanilles

1. *O. WALLICHII* (Hook.) Presl, Tent. Pterid., 78, 1836; Bedd., Handb. Ferns Brit. India, 187, t. 147, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 542, 1880; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 121, 1964.

Bas.: *Aspidium vallichianum* Hook., Exotic Fil., 1, t. 5, 1823.

Common from Simla to Nainital; reported from Simla, 2,000 m; Mussoorie, 1,800 m; Khati, 2,400 m and Jageshwar, 1,800 m (Almora), growing epiphytically as well as a lithophyte in shaded, moist and humus rich places.

The rhizome is creeping anchoring the rocks or tree-trunks by its long wiry roots. Fronds are simple, papery, light green in colour and drooping forming a beautiful apparel of the tree-trunks or the rocks.

*NEPHROLEPIS* Schott

1. *N. CORDIFOLIA* (L.) Presl, Tent. Pterid., 79, 1836; Bedd., Handb. Ferns Brit. India, 282, t. 144, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 540, 1880.

Bas.: *Polypodium cordifolium* Linn., Sp. Pl., 2, 1089, 1753.

Syn.: *Nephrolepis tuberosa* Presl, Tent. Pterid., 79, 1836.

Hope reports it from Garhwal, 900-1,200 m; Ganges valley, 1,000 m; Bageshwar, 900-1,200 m (Almora) but the author has not

seen anywhere in the Western Himalayas except for a few places enroute Dalhousie, 300 m, where it is suspected to be an escape.

This is a beautiful garden plant cultivated for its long ever-green pinnate fronds. It has the advantage of having underground tubers which help in perennation and vegetative reproduction. (Strachey from Bageshwar, 900 m, dated 1848, Mackinnon from Garhwal, 1,200 m, dated April, 1881, Inayat from Gory valley, dated 27.8.1900, sheet no 25056 in CAL).

#### GLEICHENIACEOUS SERIES

Family Gleicheniaceae

#### *DICRANOPTERIS* Bernh.

1. *D. LINEARIS* (Burm.) Underw., Bull. Torrey Bot. Cl., 34, 250, 1907; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 122, 1964.

Bas.: *Polypodium lineare* Burm., Fl. Ind., 236., t. 67, f. 2, 1768.

Syn.: *Gleichenia linearis* (Burm.) Clarke, Trans. Linn. Soc. Lons., II, Bot., 1, 428, 1880; Bedd., Handb. Ferns Brit. India, 4, t. 1, 1883.

*G. dichotoma* Hook., Sp. 1, 12, 1844; Hope, Jour. Bomb. nat. Hist. Soc., 13, 25, 1900.

Collected from Thal (Kumaon), growing along roadside between 1,050-1,800 m altitude. Panigrahi and Dixit (1969c) have put it under the var. *subferruginea* (Hieron.) Nakai on the basis of hairs occurring abundantly on the costules. (Duthie from near Askot, 1,200-1,500 m, sheet no. 3652, dated 29.9.1884 and sheet no. 6280, dated 14.8.1886 in DD; Strachey from Phurkia, 1,800 m, dated 1848, sheet in CAL).



Family Cyatheaceae

*CYATHEA* Smith

1. *C. SPINULOSA* Wall. *ex* Hook., Sp. Fil., 1, 25, t. 12C, 1844; Bedd., Handb. Ferns Brit. India, 6, t. 3, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 429, 1880; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 124, 1964.

This is a new record for the area. Presently collected from Chamoli, 900 m (Garhwal) extending its westward limit of distribution.

The plants were small in size growing on a moist and shaded bed of a nallah.

Family Onoleaceae

*METTEUCCIA* Todaro

1. \**M. ORIENTALIS* (Hook.) Trev., Atti Ist. Veneto, III, 14, 586, 1869; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 124, 1964.

Bas.: *Struthiopteris orientalis* Hook., 2nd Cent. Ferns. t. 1860; Bedd., Handb. Ferns Brit. India, 20, t. 9, 1883.

Syn.: *Onoclea orientalis* Hook., Syn. Fil., 4, 161, 1862; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 434, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 27, 1900.

Not observed. (Gamble reported from Lokandi hill, Jaunsar, 2,550 m, dated June, 1891, sheet no. 24828, Duthie from Lokandi hill, 2,400-2,700 m, dated 19.4.1894, sheet no. 14465, Mackinnon from North of Chakrata, dated April, 1902, sheets in CAL).

Family Woodsiaceae

WOODSIA R. Br.

1. *W. ELONGATA* Hook., Sp. Fil., 1, 62, t. 21C, 1844; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 435, 1880; Bedd., Handb. Ferns Brit. India, 22, t. 10, 1883. Dhir and Dutta, Nova Hedwigia, 27, 394, 1976.

A high altitude species; reported from Hattoo, 3,000 m (Simla); Hemkund, 3,300 m (Garhwal); Khati, 2,400 m (Almora), growing gregariously on exposed ridges. It is occasionally seen on shaded and humus rich rocks along water channels.

Fronde tufted, long, narrow, articulated and densely covered with woolly hairs; sori large, globose and prominent.

2. \**M. LANOSA* Hook., Syn. Fil., 47, 1866; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 435, 1880; Bedd., Handb. Ferns Brit. India, 22, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 125, 1964.

Syn.: *Gymnogramme andersoni* Bedd., Ferns Brit. India, t. 190, 1866; Hope, Jour. Bomb. nat. Hist. Soc., 15, 100, 1903.

Not common, Hope (l.c.) reported it from Pindari, 3,600 m and Garhwal between 3,600-3,900 m. Strachey (1906) also mentioned the same locality. (Duthie from Kauri pass, 3,300-3,900 m, sheet in DD; Duthie from Kali valley, 3,600 m, dated 15.9.1884, sheet no. 3706 in CAL).

3. \**W. ALPINA* (Bolton) Gray, Nat. Arr. Brit. Pl., 2, 17, 1821; Stewart, Bull. Torrey Bot. Cl., 72, 404, 1945; Schelpe, Amer. Fern Jour., 44, 61, 1954.

Bas.: *Acrostichum alpinum* Bolton, Fil. Brit., 76, t. 42, 1790.

Syn.: *Woodsia hyperborea* R. Br., Prod. Fl. Nov. Holl., 1, 158, 1810; Bedd., Handb. Ferns Brit. India, 20, 1883; Clarke Trans. Linn. Soc. Lond., II, Bot., 1, 434, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 27, 1900.

An alpine plant of rock cliffs. Rare; not observed by the author. (Harsukh from Pangri valley, 3,700 m, dated 18.7.1899, sheet no. 23359, Stewart from Kolahoi glacier, 4,200 m, dated August, 1927, sheet no. 9446 in DD; Duthie from Lidder valley, 3,600 m, dated 21.7.1893, sheet no. 13148 in CAL).

4. \**W. aff. HANCOCKII* Baker, Ann. Bot. 5, 196, 1891.

Schelpe (1954) reported it from Kangra valley, growing in *Rhododendron* scrubs in the Alpine conditions. Not observed by the author.

#### PERANEMA D. Don

1. \**P. CYATHEOIDES* D. Don, Prod. Fl. Nepal., 12, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 435, 1880; Bedd., Handb. Ferns Brit. India, 22, t. 11, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 125, 1964.

Syn.: *Sphaeropteris barbata* Wall., List. no. 183, 1828; Hope, Jour. Bomb. nat. Hist. Soc., 13, 28, 1900.

Hope (l.c.) reported it from Garhwal hills between, 2,100-2,700 m altitude. (Mackinnon from Garhwal, 2,100-2,700 m, dated April, 1881 and from Mussoorie, dated 1910, Blanford from Garhwal, 2,400 m, sheets in CAL).

#### Family Aspidiaceae

#### DRYOPTERIS Adanson

1. *D. PANDA* (Clarke) Christ, Bull. Geogr. Bot. Mem., 20, 176, 1909; C. Chr., Ind. Fil. Suppl. III, 94, 1934; Dhir and Datta, Nova Hedwigia, 27, 396, 1976.

Bas.: *Nephrodium filix-mas* var. *panda* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 519, Pl. 68, f. 1, 1880.

Syn.: *Lastrea filix-mas* var. *panda* Bedd., Handb. Ferns Brit. India, 251, 1883.

*Nephrodium pandum* Hope, Jour. Bomb. nat. Hist. Soc., 12, 623, 1899.

A rare species; presently collected it from Dharamsala and Garhwal areas between 2,400-3,300 m altitude. (Duthie from Ramganga valley, sheet no. 2223 and Kidarkanta, sheet no. 3659 in DD); Clarke from Dharamsala, 3,000 m, dated 15.10.1874, sheet no. 24475, Duthie from Ganges valley, 3,300-3,600 m, dated Oct., 1881, sheet no. 2223, Mackinnon from Garhwal, dated May, 1881 in CAL).

2. *D. ATRATA* (Wall. ex Presl) Ching, Sinensia, 3, 326, 1933; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 130, 1964.

Bas.: *Lastrea atrata* Wall., ex Presl, Tent Pterid., 77, 1836.

Syn.: *Lastrea hirtipes* Bedd., Handb. Ferns Brit. India, 232, 1883 (pro parte).

*Nephrodium gamblei* Hope, Jour. Bomb. nat. Hist. Soc., 12, 533, t. 7, 1899.

*N. hirtipes* Hook., Sp. 4, 115, t. 249, 1862; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 513, 1880 (pro parte); Hope, Jour. Bomb. nat. Hist. Soc., 14, 721, 1903

Reported from Simla and Garhwal hills between 1,500-1,800 m altitude. Presently observed below Satrundi, 2,100 m, enroute Pangi growing under a big boulder in sheltered places. (Gamble from Jaunsar, 2,100 m, sheet no. 23553 in CAL, one sheet in DD).

3. *D. SINO-FIBRILLOSA* Ching, Bull. Fan Mem. Inst. Biol. Bot. 10, 180, 1940; Dhir and Datta, Nova Hedwigia, 27, 398, 1976.

Syn.: *D. fibrillosa* (Clarke) Hand.- Mazz., Akad. Ans. Akad. Wien, 49, 1922.

*Lastrea filix-mas* var. *parallelogramma* sub-var. *fibrillosa* Bedd., Handb. Ferns Brit. India, 250, 1883.

*Nephrodium filix-mas* var. *fibrillosa* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 520, t. 70, 1880.

A high altitude fern; collected from Pahlgam, 2,200 m (Kashmir);

Rahla, 2,600 m (Kulu); Hattoo, 3,000 m (Simla); Hemkund, 2,400-3,000 m (Garwal) and Dwali, 2,700 m (Almora), growing on humus rich and densely shaded forest floor often forming beautiful baskets. Stipe with brown-black shining scales; pinnules slightly denticulate and the under surface fibrillose. It is a diploid apomict with 'n' = 82.

4. *D. WALLICHIANA* (Spreng.) Hyl. Bot. Notis. 1963, 352, 1953; Alston and Bonner in Candollea, 15, 216, 1956.

Bas.: *Aspidium wallichianum* Spreng, Syst., 4, 104, 1827.

Syn.: *Dryopteris paleacea* (D. Don) Hand.-Mazz., Verh. Zool.-Bot. Ges. Wien, 58, 100, 1908; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 131, 1964.

*Nephrodium filix-mas* var. *patentissima* sensu Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 520, 1880 (pro parte).

*Lastrea filix-mas* var. *parallelogramma* Bedd., Handb. Ferns. Brit. India, 249, 1883 (pro parte).

A high altitude species; common in the valleys of Kumaon. Collected from Dhakuri, 2,800 m and Dwali, 2,900 m (Almora), growing under the *Rhododendron* scrub with basket like habit.

5. *D. SERRATO-DENTATA* (Bedd.) Hayata, Ic. Pl. Formos., 4, 179, 1941; Ching, Ic. Fil. Sinicarum, 4, Pl. 178, 1937; Stewart, Bull. Torrey Bot. Cl., 72, 406, 1945.

Bas.: *Lastrea filix-mas* var. *serrato-dentata* Bedd., Handb. Ferns Brit. India, Suppl., 55, 1892.

Syn.: *Nephrodium serrato-dentatum* Hope, Jour. Bomb. nat. Hist. Soc., 12, 622, t. 10, 1899.

*N. odontoloma* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 521, 1880.

*Lastrea odontoloma* Bedd., Handb. Ferns Brit. India, 248, t. 128, 1883 (non Moore, 1958; Bedd., 1863-1865).

A high altitude fern; not uncommon in the Western Himalayas. Observed near Satrundi, 3,300 m, enroute Pangi growing on a

cliff in open situations. Hope (l.c.) has reported it from Kashmir, Ravi valley and Gangotri between 3,300-4,500 m altitude. (Duthie from Relam valley, Lace from Pangri valley, Stewart from Lidder valley, sheets in DD).

6. \**D. ACUTO-DENTATA* Ching, Bull. Fan. Mem. Inst. Biol., 8, 432, 1938; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 132, 1964.

Syn.: *Nephrodium kingii* Hope, Jour. Bomb. nat. Hist. Soc. 12, 621, t. 9, 1899.

Reported from Ravi valley, above Simla and in Garhwal hills between 2,700-4,500 m altitude.

7. *D. BARBIGERA* (Moore) O. Ktze., Rev. Gen. Pl., 2, 812, 1891; Ching in Bull. Fan Mem. Inst. Biol., 8, 431, 1938; Dhir and Datta, Nova Hedwigia, 27, 400, 1976.

Bas.: *Nephrodium barbigerum* Hook., Sp. Fil., 4, 113, 1862; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 522, 1880.

Syn.: *Lastrea barbigerum* Moore in Bedd., Handb. Ferns Brit. India, 246, t. 127, 1883.

A very common and handsome alpine species met with in Northern India. Collected from Chandan-wari, 3,000 m (Kashmir); Hemkund, 3,000 m and Rhurkia, 3,600 m (Almora), growing gregariously in alpine meadows.

Fronds herbaceous, edges of pinnules often incurved, rachis and rachilets covered with light brown scales.

8. *D. ODONTOLOMA* (Moore) C. Chr., Acta Hort. Gothob., 1, 59, 1924; Dhir and Datta, Nova Hedwigia, 27, 400, 1976.

Bas.: *Lastrea odonotoloma* Moore, Ind. Fil., 90, 1858.

Syn.: *Nephrodium filix-mas* var. *normalis* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 519, t. 68, f. 2, 1880.

*N. odontoloma* Hope, Jour, Bomb. nat. Hist. Soc., 14, 736, t. 31, 1903.

One of the commonest *Dryopteris* species of the Western Himalayas. Met with near Pahlgam, 2,200 m (Kashmir); around Kulu and Manali, 1,500-2,400 m; near Lakarmandi, 1,800-2,400 m (Dalhousie); around Simla, 1,800-2,200 m; Jabarkhet, 2,100 m (Mussoorie); Valley of Flowers, 3,000 m (Garhwal) and Rattighat, 1,800 m; Cheena peak and Laria-kanta, 2,400 m (Nainital).

Generally grows on moist, densely shaded and humus rich forest floor but occasionally seen in open situations in the oak forests. Characterised by pale straw-coloured stipe and rachis, pale dull green frond and sori on the upper half of the lamina.

9. *D. CHRYSOCOMA* (Christ) C. Chr., Ind. Fil., 257, 1905; Dhir and Datta, Nova Hedwigia, 27, 401, 1976.

Bas.: *Aspidium filix-mas* var. *chrysocoma* Christ, Bull. Herb. Boiss., 6, 966, 1898.

Syn.: *Nephrodium filix-mas* var. *schimperiana* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 520, t. 69, f. 2, 1880.

*Lastrea filix-mas* var. *elongata* Bedd., Handb. Ferns Brit. India, 250, 1883 (pro parte).

*L. filix-mas* var. *schimperiana* Bedd., Handb. Ferns Brit. India, Suppl., 58, 1892.

*Nephrodium schimperianum* Hope, Jour. Bomb. nat. Hist. Soc., 14, 733, 1903.

*Dryopteris macrocarpa* Stewart, Bull. Torrey Bot. Cl., 72, 406, 1945.

Very common near Kulu, 1,200 m; Lakarmandi, 2,400 m (Dalhousie); Mashobra, 2,400 m (Simla); Jabarkhet, 2,100 m (Mussoorie); en-

route Hemkund, 2,700 m (Garhwal) and around Nainital, 1,800-2,400 m and near Dwali, 2,700 m (Almora).

The species prefers exposed situations growing on the rocky walls and occasionally on shaded, humus rich forest floor.

10. *D. COCHLEATA* (D. Don) C. Chr., Ind. Fil., 258, 1905; Mehra and Dhir, Bull. Bot. Surv. India, 10, 305, 1968; Dhir and Datta, Nova Hedwigia, 27, 398, 1976.

Bas.: *Nephrodium cochleatum* D. Don, Prod. Fl. Nepal., 6, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 521, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 734, 1903.

Syn.: *Lastrea filix-mas* var. *cochleata* Bedd., Handb. Ferns Brit. India, 250, t. 130, 1883.

A common low altitude species found between Nainital and Dalhousie. Collected from near Bathri, 1,200 m (Dalhousie); near Rampur, 900 m (Simla); Rajpur enroute Mussoorie, 1,200 m; near Chamoli, 1,350 m (Garhwal); Sat-tal, 1,500 m (Nainital) and near Bharari, 1,200 m (Almora).

A hardy xerophytic species generally occupying the exposed rocks. Fronds distinctly dimorphic; fertile fronds with very prominent indusia covering whole of the under-surface. But the author has collected on abnormal specimen from Chamoli with a few scattered sori on the vegetative frond.

11. *D. BLANFORDII* (Hope) C. Chr., Ind. Fil., 254, 1905; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 133, 1964.

Bas.: *Nephrodium blanfordii* Hope, Jour. Bomb. nat. Hist. Soc., 12, 624, t. 11, 1899.

A high altitude species; quite common near Gulmarg, 2,800 m and Pahlgam, 2,200 m (Kashmir), growing on shaded, humus rich soil along water channels. Around Narkanda, 2,700 m (Simla) and near Hemkund, 3,300 m (Garhwal), it is observed growing in moist and shaded conditions.



12. *D. MARGINATA* (Wall. *ex* Clarke) Christ in Phil. Jour. Sci. Bot., 2, 212, 1907; Dhir and Datta, Nova Hedwigia, 27, 403, 1976.

Bas.: *Nephrodium filix-mas* var. *marginata* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 521, t. 71, 1880.

Syn.: *N. marginatum* Hope, Jour. Bomb. nat. Hist. Soc., 14, 740, t. 33, 1903.

Fairly common in the area between 1,500-2,400 m. Collected from near Bathri, 1,500 m (Dalhousie); near Simla, 1,800 m; Jabarkhet, 2,400 m (Mussoorie); Bhowali, 1,500 m and Land's end, 2,250 m (Nainital) and near Khati, 2,400 m (Almora).

Prefers densely shaded, moist and calcareous forest floor along water channels. It is a large fern with triangular tripinnate frond and dark green in colour.

13. *D. RAMOSA* (Hope) C. Chr., Ind. Fil., 287, 1905; Stewart, Bull. Torrey Bot. Cl., 72, 406, 1945.

Bas.: *Nephrodium ramosum* Hope, Jour. Bot., 126, 1896 and Jour. Bomb. nat. Hist. Soc., 14, 739, t. 32, 1903.

Extremely common in Kashmir valley but scarce eastwards so that in Garhwal and Kumaon hills it is rare. Collected from near Gulmarg, 2,700 m, Pahlgam, 2,200 m, Amarnath, 3,300 m and Kolahoi, 3,000 m (Kashmir); enroute Hattoo, 2,700 m (Simla); near Jhangi, 2,400 m (Kalpa valley) and enroute Hemkund, 2,700 m (Garhwal).

It inhabits moist, shaded and humus rich forest floor generally along the streamlets. A variable species ranging from a small fern to one of the largest forms of *D. filix-mas* group. Fronds 25-70 cm in length and 25-30 cm in breadth, pale green in colour with straw-coloured stipe and rachises clothed by pale coloured linear scales and fibrils.

14. *D. SUBIMPRESA* Loyal, Nova Hedwigia, 16, 467, f. 9, 1968.

Collected from Khati-Dwali road enroute Pindari, 2,550 m (Almora), growing in moist, shaded and humus rich places in the dense forests. New record for the area under investigation.

15. *D. SPARSA* (D. Don) O. Ktze., Rev. Gen. Pl., 2, 813, 1891; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 133, 1964.

Bas.: *Nephrodium sparsum* D. Don, Prod. Fl. Nepal., 6, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 523, 1880 (excl. vars.).

Syn.: *Lastrea sparsa* Moore, Ind. Fil., 87, 104, 1858; Bedd., Handb. Ferns Brit. India, 252, 1883 (excl. vars.).

Collected from Thal, 1,200 m (Almora), growing on moist shaded slopes. (Mackinnon reported it from Bhatoli on Chakrata-Mussoorie road, 1,200 m, dated 20.3.1903, sheet in DD).

#### *POLYSTICHUM* Roth

1. *P. NEPALENSE* (Spr.) C. Chr., Ind. Fil., 84, 1905, 585, 1906; Dhir and Datta, Nova Hedwigia, 27, 404, 1976.

Bas.: *Aspidium nepalense* Spr., Syst., 4, 97, 1827.

Syn.: *Aspidium auriculatum* Sw. var. *marginata* Wall. in Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 507, 1880.

*Polystichum auriculatum* Bedd. var.  $\beta$  *marginatum* Wall. in Bedd., Handb. Ferns Brit. India, 204, 1883.

*Aspidium marginatum* Wall., List no. 366, 1828 (nomen nudum); Hope, Jour. Bomb. nat. Hist. Soc., 14, 459, t. 17, 1902.

Collected from Khati-Dwali road, 2,700 m (Almora), growing in

moist shaded and humus rich places along the Pinder river.  
(Stewart found it near Alwas (Dalhousie) under damp ledge at  
2,700 m, dated 27.6.1917, sheet no. 2473 in DD).

2. *P. LACHENENSE* Bedd., Ferns Brit. India, 32, 1865 and Handb.  
Ferns Brit. India, 203, 1883; Stewart, Bull. Torrey Bot. Cl.,  
72, 411, 1945; Schelpe, Amer. Fern Jour., 44, 61, 1954.

Bas.: *Aspidium lachenense* Hook., Sp. Fil., 4, 8, t. 212, 1862; Clarke, Trans  
Linn. Soc. Lond., II, Bot., 1, 506, 1880; Hope, Jour. Bomb. nat. Hist. Soc.,  
14, 458, 1902.

Plentiful in Kashmir valley at high altitudes. Collected from  
Kolahoi, 3,600 m and Pindari, 3,600 m (Garhwal) growing in the  
crevices of shaded rocks.

3. *P. DUTHIEI* (Hope) C. Chr., Ind. Fil., 72, 1905; 581, 1906.

Bas.: *Aspidium duthiei* Hope, Jour. Bomb. nat. Hist. Soc., 12, 532, t. 6,  
1899.

Rare; collected from Pindari, 3,900 m (Almora). Hope (l.c.) re-  
ported it from Garhwal and Kutti valley, 3,900-4,500 m but no  
subsequent worker has mentioned its occurrence in the area.

4. *P. OBLIQUUM* (D. Don) Moore, Ind. Fil., 87, 1858; Dhir and  
Datta, Nova Hedwigia, 27, 405, 1976.

Bas.: *Aspidium obliquum* D. Don, Prod. Fl. Nepal., 3, 1825.

Syn.: *A. auriculatum* Sw. var. *caespitosa* Clarke, Trans. Linn. Soc. Lond.,  
II, Bot., 1, 507, 1880.

*Polystichum auriculatum* (L.) Presl var. *caespitosum* Bedd., Handb. Ferns  
Brit. India, 204, 1883.

A low level ravine fern growing on shaded and humus rich walls  
of the streamlets. Fairly common in Chadwick-falls, 1,500 m  
(Simla); Mossy-falls, 1,200 m (Mussoorie) and Dhobi Khud,  
1,500 m (Nainital). Not reported from Simla westwards.

5. *P. LENTUM* (D. Don) Moore, Ind. Fil., 86, 1358; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 126, 1964.

Bas.: *Aspidium lentum* D. Don, Prod. Fl. Nepal., 4, 1825.

Syn.: *Polystichum auriculatum* var. *lentum* Bedd., Handb. Ferns Brit. India, 204, 1883.

*Aspidium auriculatum* Sw. var. *lenta* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 507, 1880.

Extremely common on Chakrata road, 1,500 m (Mussoorie); Chamoli, 1,350 m (Garhwal), growing on shaded and humus rich rocky slopes along water channels.

6. *P. STIMULANS* (Kze. ex Mett.) C. Chr., Contr. U.S. Nat. Herb., 26, 285, 1931; Dhir and Datta, Nova Hedwigia, 27, 408, 1976.

Bas.: *Aspidium stimulans* Kze. ex Mett., Abhandl. Senckenb. Naturf. Gesell., 2, 327, 1858.

Syn.: *Aspidium ilicifolium* D. Don, Prod. Fl. Nepal., 3, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 508, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 464, 1902.

*Polystichum ilicifolium* sensu Bedd., Handb. Ferns Brit. India, 206, t. 103, 1883.

A common fern of higher altitudes; found near Mashobra, 2,400 m (Simla); enroute Hemkund, 2,400 m (Garhwal) and near Dwali, 2,700 m (Almora).

It prefers to grow on moist shaded rocks along the water channels. The plants are simple pinnate with pinnae triangular to sub-rhomboidal.

7. *P. THOMSONI* (Hook. fil.) Bedd., Ferns Brit. India, t. 126, 1866 and Handb. Ferns Brit. India, 206, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 127, 1964.

Bas.: *Aspidium thomsoni* Hook. fil. in Hook., 2nd Cent., t. 25, 1860 (pro parte); Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 508, 1880.

A common species of Western Himalayas at higher altitudes. Collected from near Kolahoi, 3,600 m (Kashmir); enroute Rohtang, 2,700 m (Kulu valley); Narkanda, 2,700 m (Simla); Jhangi, 2,400 m (Kalpa valley); Pangote, 1,500 m (Nainital) and enroute Pindari, 2,400-3,000 m (Almora).

It is quite elegant, shade loving fern growing lithophytically on densely shaded and gravelly walls. It shows a great variation in size ranging from 6.5 to 25 cm in length.

8. *P. PRESCOTTIANUM* (Wall. ex Mett.) Moore, Ind. Fil., 101, 1858; Bedd., Handb. Ferns Brit. India, 210, t. 105 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.) 15, 127, 1964.

Bas.: *Aspidium prescottianum* Wall. ex Mett., Pheg. Asp. 48, n. 110, 1858; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 510, 1880.

One of the commonest species of the upper temperate and alpine zones. Collected from around Gulmarg, 2,850 m and Aparwat, 3,900 m (Kashmir); near Hattoo, 3,100 m (Simla) and enroute Pindari, 3,000-3,200 m (Almora).

It grows gregariously on open, exposed forest floor forming dense patches. Occasionally seen under the shade of the rocks near the permanent snow-line.

\*var. *bakerianum* (Atk. ex Clarke) Bedd., Handb. Ferns Brit. India, 210, 1883.

Bas.: *Aspidium bakerianum* Atk. MS, Bak., Ic. Pl., t. 1656, 1886.

Syn.: *Aspidium prescottianum* Wall. var. *bakeriana* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 510, Pl. 66, 1880.

Clarke (l.c.) reported it from the Himalayas between 3,000-3,900 m. Stewart (1945) also recorded it from Kashmir valley. Not seen by the author. (Clarke from Dharmsala, 3,300 m, dated 15.10.1874, sheet no. 24511 and from Kashmir, dated 3.9.1876, sheet no. 30992 in CAL).

9. *P. ACANTHOPHYLLUM* (Franch.) Christ, Bull. Soc. Bot. Franc., 52, Mem., 1, 30, 1905; Dhir and Datta, Nova Hedwigia, 27, 406, 1976.

Bas.: *Aspidium acanthophyllum* Franch., Bull. Soc. Franc., 32, 28, 1885.

Common in Garhwal and Kumaon hills between 1,800-3,000 m. Collected from Joshimath-Badrinath road at 2,400 m, enroute Hemkund, 1,800-2,700 m and Valley of Flowers, 3,000 m (Garhwal) and near Punnawala, 2,100 m (Almora). Bir (1963) reported it from near Hattoo, 3,000 m (Simla).

Grows in moist and shaded gorges and occasionally under the shade of rocks in the alpine zone.

10. *P. ACULEATUM* (L.) Schott, Gen. Fil., ad. t. 9, 1834; Bedd., Handb. Ferns Brit. India, 207, 1883; Dhir and Datta, Nova Hedwigia, 27, 408, 1976.

Bas.: *Polypodium aculeatum* Linn., Sp. Pl., 2, 1090, 1753.

Syn.: *Aspidium aculeatum* Sw., 1801; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 509, 1880.

It is found throughout the Himalayas between 1,500-2,400 m. Collected from Tangmarg, 2,100 m (Kashmir), around Dalhousie, 2,000-2,400 m; near Manali, 2,400 m; around Simla and Mussoorie, 1,800-2,400 m; near Joshimath, 1,500 m (Garhwal); around Nainital from Pangote, 1,500 m to Cheena peak, 2,400 m and near Loharkhet, 1,800 m (Almora).

Prefers humid, shaded and humus rich forest floor, growing under the cover of bushes.

11. *P. SETOSUM* Schott, Ge. Fil. ad. t. 9, 1834.

Syn.: *Aspidium aculeatum* Sw. var. *setosa* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 510, 1880.

Observed near Khati, 2,400 (Almora), growing in moist, shaded and humus rich places in the dense forest.

12. *P. DISCRETUM* (D. Don) Diels, Nat. Pfl. 1<sup>4</sup>, 199, 1899.

Bas.: *Aspidium discretum* D. Don., Prod. Fl. Nep., 4, 1825.

Extremely common in Kumaon hills, collected from Company Garden, 1,800 m (Mussoorie), near Pangote, 1,600 m (Nainital) and near Almora, 1,800 m growing on moist, densely shaded and humus rich forest floor along the streamlets.

13. *P. BIARISTATUM* (Bl.) Moore, Ind. Fil., 86, 1858; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 128, 1964.

Bas.: *Aspidium biaristatum* Bl., Enum. Pl. Jav., 164, 1828.

Syn.: *Polystichum aculeatum* Sw. var. *biaristatum* Bedd., Handb. Ferns Brit. India, 209, 1883.

*Aspidium aculeatum* Sw. var. *biaristata* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 510, 1880.

Collected from near Khati, 2,400 m (Almora), growing on densely shaded and humus rich forest floor along the Pinder river. New record for the area.

14. *P. SQUARROSUM* (D. Don) Fée, Gen. Fil., 278, 1850-52; Stewart, Torrey Bot. Cl., 412, 1945; Mehra and Dhir, Bull. Bot. Surv. India, 10, 305, 1968; Dhir and Datta, Nova Hedwigia, 27, 408, 1976.

Bas.: *Aspidium squarrosum* D. Don, Prod. Fl. Nepal., 4, 1835.

Syn.: *Polystichum aculeatum* Sw. var. *rufobarbatum* (Wall.) Bedd., Handb. Ferns Brit. India, 207, 1883.

*P. aculeatum* Sw. var. *rufo-barbata* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 509, 1880.

Rare in Kashmir but common westwards between 1,650-2,700 m. Collected from near Pahlgam, 2,200 m (Kashmir); around Dalhousie, 1,800-2,400 m; near Manali, 2,100 m; Narkanda, 2,700 m

and Chadwick-falls, 1,650 m (Simla); Mussoorie, 1,800-2,100 m; and around Nainital from Bhowali, 1,650 m to Cheena peak, 2,400 m.

Always grows on shaded and humus rich forest floor. One of the hardiest species of the area under survey. It forms an elegant basket, the character responsible for its common name 'basket fern'.

15. *P. LONCHITIS* (L.) Roth, Rom. Mag. 2<sup>1</sup>, 106, 1799; Bedd., Handb. Ferns Brit. India, 203, 1883; Stewart, Bull. Torrey Bot. Cl., 72, 411, 1945.

Bas.: *Polypodium lonchitis* Linn., Sp. Pl., 1088, 1753.

Syn.: *Aspidium lonchitis* Sw., Schrad. Jour., 1800<sup>2</sup>, 30, 1801; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 505, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 458, 1902.

A species of cold temperate and alpine zones occurring above 2,700 m. Very common near Kolahoi glacier, 2,700-3,600 m and near Sonamarg, 3,000 m (Kashmir), growing in the snow gullies and in the stones wherever a little humus is present.

16. *P. NEO-LOBATUM* Nakai, Bot. Mag., Tokyo, 39, 118, 1925; Alston et Bonner, Candollea, 15, 212, 1956; Nishida, Jour. Coll. Arts Sci., Chiba Univ., 4, 578, 1966; Hara, Fl. East. Himalaya, 480, 1968.

Rare; observed near Dwali, 2,700 m (Almora), growing on very moist, shaded and humus rich forest floor. Differs from *P. squarrosus* in having long, linear, dark brown scales on stipe and rachis, pinnules triangular with acuminate apex, with anterior margin of pinnule overlapping the posterior margin of the pinnule in the next row. New record for the area. (R.L. Fleming collected it from W. Nepal, dated 1.12.1949, sheet no. 886 in DD).



17. \**P. TSUS-SIMENSE* (Hook.) J. Smith, Hist. Fil., 219, 1875; Stewart, Bull. Torrey Bot. Cl., 72, 412, 1945.

Bas.: *Aspidium tsus-simense* Hook., Sp. Fil., 4, 16, P. 220, 1862.

Syn.: *Aspidium luctuosum* Hope, Jour. Bomb. nat. Hist. Soc., 14, 475, 1902.

Reported from Jhelum valley near Rampur, 1,350 m (Kashmir) and Ravi valley, 2,100 m (Dalhousie).

18. \**P. MOUPINENSE* (Franch.) Bedd., Handb. Ferns Brit. India, Suppl., 42, 1892; Schelpe, Amer. Fern Jour., 44, 59, 1954.

Bas.: *Aspidium moupinense* Franch., Nouv. Arch. Mus., II, 10, 115, 1887.

Schelpe (l.c.) reported it from Kangra valley growing in wet boulder-strewn gullies associated with *Osmunda claytoniana* Linn. and *Diplazium sibiricum* (Kze.) Kurata.

#### ARACHNIODES Blume

(= *Byrsopteris* Morton)

1. \**A. ARISTATA* (Forst. f.) Tindale, Contr. New South Wales nat. Herb., 3, 89, 1961; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 128, 1964; Nair, Bull. Bot. Surv. India, 11, 185, 1969.

Bas.: *Polypodium aristatum* Forst. f., Prod., 82, 1786.

Syn.: *Aspidium aristatum* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 511, 1880 (excl. vars.).

*Lastrea aristata* Moore, Ind. Fil., 85, 1858; Bedd., Handb. Ferns Brit. India, 229, 1883.

*Rumora aristata* Ching, Sinensia, 5, 50, 1934.

*Polystichopsis aristata* Holttum, Fl. Malaya, II, 486, 1954.

*Byrsopteris aristata* (Forst. f.) Morton, Amer. Fern Jour., 50, 152, 1960.

Hope (1903) reported it from Chamba, 900-1,050 m and Kumaon.

Trotter vide Stewart (1945) reported it from Kashmir. Not seen by the author.

#### CYRTOMIUM Presl

1. *C. CARYOTIDEUM* Presl, Tent. Pterid., 86, t. 2, f. 26, 1836; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 129, 1964.

Syn.: *Aspidium falcatum* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 512, 1880 (pro parte).

*Cyrtomium falcatum* Sw. var. *caryotideum* (Wall.) Bedd., Handb. Ferns Brit. India, 212, t. 106, 1883.

A rare fern of the area. Occasionally a few individuals are seen in some localities like Karelnu water-falls, 1,800 m (Dalhousie), Mossy-falls, 1,500 m (Mussoorie) and Khati-Dwali road (Almora) at about 2,100 m. A few individuals were seen near Theog, 2,100 m (Simla). Stewart (1945) reports it from Kashmir.

Always prefers moist and gravelly soil along the streamlets.

#### TECTARIA Cavanilles

1. *T. MACRODONTA* (Fée) C. Chr., Ind. Fil., Suppl., III, 181, 1934; Dhir and Datta, Nova Hedwigia, 27, 412, 1976.

Bas.: *Sagenia macrodonta* Fée, Gen. Fil. 313, t. 24A, f. 1, 1850-52.

Syn.: *Aspidium cicutarium* (L.) Sw., Schrad. Jour., 1800<sup>2</sup>, 36, 1801; Bedd., Handb. Ferns Brit. India, 220, 1883.

*Nephrodium cicutarium* Bak., Syn. Fil., 299, 1867; Clarke, Trans. Linn. Soc Lond., II, Bot., 1, 539, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 747, 1903.

A common low level fern of Garhwal and Kumaon Himalayas. Col-

lected from near Chamoli, 1,350 m (Garhwal); near Bhowali, 1,200 m and Mangoli, 1,200 m (Nainital) and enroute Pindari, 1,500-2,400 m (Almora). Hope (lc.) reported it from Chamba eastwards.

Always prefers the shade of shrubs and occasionally grows on the shaded rocks along roadside.

#### *HYPODEMATIUM* Kunze

1. *H. CRENATUM* (Forssk.) Kuhn, v. Deck. Reis, 3<sup>3</sup>, Bot., 37, 1879; Ching, Ic. Fil. Sin., 3, t. 121, 1935; Mehra and Dhir, Bull. Bot. Surv. India, 10, 305, 1968; Dhir and Datta, Nova Hedwigia, 27, 410, 1976.

Bas.: *Polypodium crenatum* Forssk., Fl. Aegypt. arab., 185, 1775.

Syn.: *Nephrodium crenatum* Baker, Fl. Maur., 497, 1837; Clarke, Tran. Linn. Soc. Lond., II, Bot., 1, 524, 1880.

*Lastrea crenata* Bedd., Handb. Ferns Brit. India, 258, 1883.

Very common throughout the Western Himalayas particularly in the outer hills at low altitudes between 600-1,500 m. Collected from Bathri, 900 m (Dalhousie); Kasauli, 1,200 m; near Simla, 1,500 m; Chakrata road, 900 m (Mussoorie); Srinagar, 600 m (Garhwal); around Nainital, 600-1,300 m; and near Kapkot, 900 m (Almora). Stewart (1945) reported it from Ramban, 900 m (Kashmir).

This is a xerophytic species which prefers to grow on sunny cliffs. Base of stipe is covered with long golden chestnut coloured scales.

#### *BOLBITIS* Schott

1. *B. VIRENS* (Wall. ex Hook. et Grev.) Schott, Gen. adt. 14, 1934.

Syn.: *Acrostichum virens* Wall. ex Hook. and Grev., Ic. Fil., t. 221, 1831; Hope, Jour. Bomb. nat. Hist. Soc., 15, 103, 1903.

Inayat reported it from Kotah range (Garhwal), sheet no. 26036, dated 15.6.1902 in DD.

#### CTENITIS C. Chr.

1. \**C. HENDERSONII* (Bedd.) H. Ito in Naki et Honda, Nov. Fl. Jap., 4, 89, t. 5 (106), 10 (212), 14 (311), 18 (423), 1939.

Bas.: *Lastrea hendersoni* Bedd., Ferns Brit. India, Suppl. 17, t. 377, 1876.

Syn.: *Dryopteris hendersoni* (Bedd.) C. Chr., Ind. Fil., 270, 1905; Mehra, Ferns Muss., 15, 1939.

*Nephrodium spectabile* Clarke, Jour. Linn. Soc. Lond., II, Bot., 1, 526, 1880.

*Lastrea spectabilis* Bedd., Handb. Ferns Brit. India, 257, t. 132, 1883.

Marten (1909) reported it from Mussoorie. Not observed by the author.

#### Family Athyriaceae

#### CYSTOPTERIS Bernh.

1. *C. FRAGILIS* (L.) Bernh., Schrad. nen. Jour., 12, 26, t. 2, f. 9, 1806; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 450, 1880; Bedd., Handb. Ferns Brit. India, 70, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 35, 1900.

Bas.: *Polypodium fragile* Linn., Sp. Pl., 2, 1091, 1753.

One of the commonest high level ferns in the Western Himalayas between 2,700-4,200 m. Collected from near Gulmarg, 2,700 m, Kolahoi and Amarnath, 3,000-3,900 m (Kashmir); near Kanum, 3,000 m (Kalpa valley); enroute Hemkund, 3,300-4,200 m (Garhwal)

and near Pindari, 3,450 m (Almora). It has been observed growing at 1,800 m near Urni (Kalpa valley).

It grows on rocks in moist and shaded conditions, but occasionally found growing in sunny exposed situations.

2. \**C. MONTANA* (Lam.) Bernh. in Desv., Mem. Soc. Linn. Paris 6, 246, 1827; Stewart, Bull. Torrey Bot. Cl., 72, 404, 1945.

Bas.: *Polypodium montanum* Lam., Fl. Fr., 1, 23, 1778.

A rare high level fern growing in rock crevices in birch forests. Stewart (l.c.) reported it from Gulmarg, 2,700 m and Sonamarg, 3,150 m (Kashmir) *C. montana* Link given by Beddome (1892) and Hope (1900) is probably the same species. (Duthie from Relam glacier, 3,900 m and Dhauli valley, 3,600-3,900 m, sheets in DD; Duthie from Relam glacier, 3,900 m, dated 26.8.1884, sheet no. 3647 and in Dhauli valley, 3,600-3,900 m, dated 3.9.1884, sheets in CAL).

3. *C. DENTATA* (Dick.) Desv., Prod. Fam. Foug., 6, 263, 1827.

Bas.: *Polypodium dentatum* Dickson, Fasc. Pl. Crypt. Brit. 3, no. 1, Pl. 7, 1793.

Not uncommon; found growing in the crevices of rocks along Lidder river near Lidderwatt, 3,150 m (Kashmir).

4. *C. DICKIEANA* R. Sim, Gard. Farm. Jour. ser. 2, 308, 1848; Wiggins, Amer. Fern Jour., 44, 98, 1954.

Syn.: *C. fragilis* var. *dickieana* (Sim) Lindberg, Medd. Soc. Fauna et Flora Fennica, 32, 21, 24, 1905.

*C. fragilis* subsp. *dickieana* (Sim) Hyl., Uppsala Univ. Arsskr., 1945 (7), 59, 1945.

Collected from Gulmarg, 3,000-3,600 m (Kashmir).

5. \**C. TENUISECTA* (Bl.) Mett. in Ann. Lugd. Bat., 1,231, 1864; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 137, 1964.

Bas.: *Aspidium tenuisectum* Blume, Enum. Pl. Jav., 170, 1828.

Syn.: *Cystopteris setosa* Bedd., Handb. Ferns Brit. India, 70, t. 35, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 450, 1880.

Marten (1909) recorded it from Jabarkhet, 2,700 m (Mussoorie). (King from Garhwal, dated 1849, sheet in CAL).

#### ATHYRIUM

1. *A. ATTENUATUM* (Clarke) Tagawa, Acta Phytotax. et Geobot., 16, 177, 1956; Dhir and Datta, Nova Hedwigia, 27, 414, 1976.

Bas.: *Asplenium filix-foemina* (L.) Bernh. var. *attenuatum* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 492, Pl. 59, f. 1, 1880 (type from Kashmir).

Syn.: *Athyrium filix-foemina* (L.) Roth var. *attenuata* (Clarke) Bedd., Handb. Ferns Brit. India, 169, 1883.

Common at high altitudes in Kashmir valley; found near Kolahoi glacier, 3,000-3,600 m, growing in rock crevices along Lidder river. Fronds small, narrow and tapering at both ends. Bir (1963) reported it from Hattoo, 2,700 m (Simla).

*A. cf. attenuatum* (Clarke) Tagawa, Acta Phytotax et Geobot., 16, 177, 1956.

Met with near Pahlgam, 2,200 m (Kashmir) growing on a big boulder in damp, shaded conditions.

2. *A. RUPICOLA* (Hope) C. Chr., Ind. Fil., 145, 1905; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 137, 1964.

Bas.: *Asplenium rupicola* Hope, Jour. Bomb. nat. Hist. Soc. 12, 531, Pl. 5, 1899.

Syn.: *Asplenium filix-foemina* Bernh. var. *retusa* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 492, 1880 (pro parte).

*Athyrium filix-foemina* var. *retusa* (Clarke) Bedd., Handb. Ferns Brit. India, Suppl., 35, 1892 (pro parte), only var. *rupicola* Edge-worth, not sub-var. *rubricaula* Edgeworth.

This is again a high altitude fern, common throughout the Himalayas between 2,400-3,600 m. Collected from near Sheshnag, 3,000-3,700 m (Kashmir); Churah forest, 2,400-2,700 m (Dalhousie); near Rahla, 2,700 m (Kulu); enroute Hattoo, 2,850 m (Simla); Cheena peak, 2,400 m (Nainital) and near Dwali, 2,850 m (Almora).

Always prefers to grow in exposed places on the ridges. Occasionally seen on humus rich shaded walls.

3. *A. FLABELLULATUM* (Clarke) Tard.-Blot, Aspl. du Tonkin, 81, t. 12, 1932; C. Chr., Ind. Fil. Supply., III, 41, 1934; Mehra and Bir, Res. Subll. Panjab Univ. (N.S.), 15, 138, 1964.

Bas.: *Asplenium filix-foemina* Bernh. var. *flabellulata* Clarke, Trans. Soc. Lond., II, Bot., 1, 493, Pl. 60. 1880.

Syn.: *Athyrium filix-foemina* Roth var. *flabellulata* (Clarke) Bedd., Handb. Ferns Brit. India, 170, 1883.

Rare; met with near Pindari, 3,300 m (Almora), growing on humus rich but exposed forest floor in the alpine conditions. Extremely common in the Eastern Himalayas.

*A. aff. flabellulatum* (Clarke) Tard.-Blot. Aspl. du Tonkin, 81, t. 12, 1932.

Not common; collected from Valley of Flowers, 3,000 m (Garhwal), growing in shaded and humid conditions on the calcareous soil. Differs from the type in the cutting of the pinnules. Schelpe (1954) reported it from Kangra valley.

4. *A. filix-foemina* (L.) Roth, Rom. Mag., 2<sup>1</sup>, 106, 1799; C. Chr., Ind. Fil., Suppl., III, 41, 1934; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 140, 1964.

Bas.: *Polypodium filix-foemina* Linn., Sp. Pl. 2, 1090, 1753.

Syn.: *Asplenium filix-foemina* Hope, Jour. Bomb. nat. Hist. Soc., 14, 124, 1903 (forma typica).

Not common; collected from near Gulmarg, 2,700 m and Pahlgam, 2,400 m (Kashmir) and Pindari, 2,700 m (Almora), growing in open places on humus rich soils. It has prominent, pale yellow and rounded stipe and rachises.

*A. filix-foemina* (L.) Roth var. *intermedia*.

Closely resembles the type species. Common in Garhwal and Kumaon hills between 2,100-3,000 m, especially Gobindghat-Hemkund road, 3,000 m (Garhwal) and Khati, 2,100 m (Almora), growing on humus rich shaded forest floor along the streamlets.

5. *A. DUTHIEI* (Bedd.) Bedd., Handb. Ferns Brit. India, Suppl. 34, 1892.

Bas.: *Asplenium duthiei* Bedd., Jour. Bot., 27, 72, 1889; Hope, Jour. Bomb. nat. Hist. Soc., 14, 126, t. 25, 1902.

Met with near Hemkund, 3,300 m (Garhwal) and near Nainital, 2,400 m. Reported by Beddome (l.c.) and Hope (l.c.) from the inner valleys.

6. *A. SCHIMPERI* Moug. ex Fée, Mem. Fougères, 5 (Gen. Fil.), 187, 1850-52; Bedd., Handb. Ferns Brit. India, Suppl., 36, 1892; C. Chr., Ind. Fil., 146, 1905; Bir and Shukla, Bull. Bot. Surv. India, 3, 3-4, 268, 1966; Dhir and Datta, Nova Hedwigia, 27, 418, 1976.

Syn.: *Asplenium schimperi* A. Br., Schweinf. Beitr., 1, 224, 1867; Hope, Jour. Bomb. nat. Hist. Soc., 14, 252, 1902.

*A. filix-foemina* var. *polyspora* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 493, t. 61, f. 1, 1880.

A commonest species of *Athyrium* in the Western Himalayas between 1,500-3,000 m. Collected from around Dalhousie, 1,500-2,400 m, near Vashist, 2,400 m (Kulu); around Simla, 1,800-2,700 m; Mussoorie, 1,800-2,400 m; enroute Badrinath and



Hemkund, 1,800-3,000 m; Gwaldam, 1,500 m (Almora); around Nainital, 1,800-2,400 m; enroute Pindari, 1,800-3,000 m (Almora) and near Jageshwar, 1,800 m (Almora). Stewart (1945) reported it from Kashmir.

Always prefers to grow in damp shaded and humus rich places along the forest margins.

7. *A. PECTINATUM* Presl, Tent Pterid., 98, 1836; Bedd., Handb. Ferns Brit. India, Suppl., 36, 1892; Dhir and Datta, Nova Hedwigia, 27, 420, 1976.

Syn.: *Asplenium filix-foemina* Bernh. var. *pectinata* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 492, t. 58, 1880.

*Athyrium filix-foemina* (L.) Roth var. *pectinata* (Wall.) Bedd., Handb. Ferns Brit. India, 169, 1883.

A most delicate and brittle *Athyrium* species; common between, 1,200-2,400 m. Collected from Dalhousie, 2,000 m; near Simla, 1,800 m; Mussoorie, 1,800 m; near Chamoli, 1,200 m (Garhwal); Gwaldam, 1,500 m, around Nainital, 1,200-2,100 m; near Loharkhet, 2,400 m (Almora) and near Almora, 1,500 m.

The species flourishes in open but rather moist situations along roadsides. Sometimes occurs on partially shaded forest floor. Characterised by the finely cut pinnae with minute sori.

8. *A. falcatum* Bedd., Ferns South. India, t. 151, 1863; Mehra, Ferns Muss., 20, 1939; Stewart, 150th Ann. Vol., Roy. Bot. Gardens, Calcutta, 2, 6, 1942.

Syn.: *Athyrium drepanophyllum* (Bak.) Bedd., Handb. Ferns Brit. India, Suppl., 32, 1892.

*Asplenium drepanophyllum* Baker, Syn., ed. II, 226, 1874; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 487, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 668, 1901; Strachey, Cat. Plants Kumaon, 226, 1906.

A common low level fern observed between 1,200-1,650 m altitude. Met with near Mangoli, 1,500 m, Bhowali, 1,650 m and Sat-tal,

1,350 m (Nainital). Mehra (l.c.) reported it from Mussoorie. Prefers moist, rather exposed rocks where the diurnal changes seem to be well marked.

9. *A. SOLENOPTERIS* var. *PUSILUM* (Kze.) Moore, Ind. Fil., 187, 1860; Sledge, Ann. and Mag. Nat. Hist., Ser. 12, ix, 457, t. 15, 1956.

Bas.: *Allantodia solenopteris* var. *pusilla* Kze., Linnaea, 26, 267, 1851.

Syn.: *Athyrium gymnorgrammoides* (Kl. ex Mett.) Bedd., Ferns S. India, 52, 1863, excl. descr. et fig.

Collected from near Kulu, 1,800 m, growing on damp, shaded and humus rich forest floor.

10. *A. NIGRIPES* (Bl.) Moore, Ind. Fil., xlix, 1857, 98, 1858; Sledge, Ann. and Mag. Nat. Hist., Ser. 12, 454, t. 14, 1956; Bull. Brit. Mus. (Nat. Hist.), 2 (11), 283, 1962; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 141, 1964.

Bas.: *Aspidium nigripes* Bl., Enum. Pl. Jav., ii, 162, 1828.

Syn.: *Athyrium solenopteris* Bedd., Handb. Ferns Brit. India, 166, 1883 (pro parte), non Moore.

*Asplenium nigripes* Hope, Jour. Bomb. nat. Hist. Soc., 14, 119, 1902.

It is an extremely rare fern; found near Pangote, 2,100 m (Nainital), growing on damp, shaded and humus rich rocks in the dense forests. Bir (1963) reported it from near Hattoo, 2,700 m (Simla).

11. *A. SETIFERUM* C. Chr., Ind. Fil., 146, 1905; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 142, 1964.

Syn.: *Asplenium nigripes* Mett., var. *dissecta* Moore, Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 491, 1880.

*Athyrium nigripes* Bedd., Handb. Ferns Brit. India, 166, 1883 (pro parte).

*Asplenium tenellum* Hope, Jour. Bomb. nat. Hist. Soc., 12, 529, 1899.

Fairly common on moist rocks near the water-falls between, 1,200-1,800 m. Collected from near Kulu, 1,200 m; Panjpulla, 1,800 m (Dalhousie) and Chadwick-falls, 1,500 m (Simla).

12. *A. CLARKEI* Bedd., Ferns Brit. India, Suppl., II, t. 360, 1876; Mehra and Dhir, Bull. Bot. Surv. India, 10, 305, 1968.

Syn.: *Athyrium tenuifrons* Moore, Ind. Fil., 43, 188, 1857.

*A. nigripes* var. *B. Clarkei* Bedd., Handb. Ferns Brit. India, 166, 1863.

*A. nigripes* var. *tenuifrons* Bedd., Handb. Ferns Brit. India, Suppl., 33, 1892.

*Asplenium tenuifrons* Wall., Cat. no. 206, 1828; Hope, Jour. Bomb. nat. Hist. Soc., 14, 120, t. 22, 1903.

*A. clarkei* Atk. MS; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 489, 1880.

Quite common on moist shaded rocks along the streamlets or occasionally in the beds of streams. Met with near Manali, 2,100 m; enroute Khajjiar, 2,100 m (Dalhousie); Chadwick-falls, 1,500 m (Simla); Tapri-Urni road, 1,800 m (Kalpa valley) and near Kilbri, 1,500 m (Nainital).

13. *A. MACKINONI* (Hope) C. Chr., Ind. Fil., 143, 1905; Mehra and Dhir, Bull. Bot. Surv. India, 10, 305, 1968; Dhir and Datta, Nova Hedwigia, 27, 418, 1976.

Bas.: *Asplenium mackinonni* Hope, Jour. Bot., 34, 124, 1896 and Jour. Bomb. nat. Hist. Soc., 14, 122, t. 23, 1902.

Syn.: *Athyrium nigripes* Bedd., Handb. Ferns Brit. India, 166, 1883 (pro parte).

Extremely common in Kashmir valley between 1,800-3,000 m altitude. Collected from Tangmarg, 2,100 m, Pahlgam, 2,200 m, enroute Kolahoi and Amarnath, 2,100-3,000 m (Kashmir); Churah forest, 2,400 m (Dalhousie). Grows in moist, gravelly soil of forests along the streamlets.

A juvenile form of *A. mackinnoni* has been observed near Tangmarg, 2,200 m (Kashmir). It is closely allied to *A. mackinnoni* but differs in having subentire pinnae.

The species has been found to be a polyploid complex occurring as diploid ( $n = 40$ ), tetraploid ( $n = 80$ ) and hexaploid ( $n = 120$ ), and this probably explains the variability in the species

*A. cf. mackinnoni* (Hope) C. Chr., Ind. Fil., 143; 1905.

Closely allied to *A. mackinnoni* (Hope) C. Chr. Met with in Ferozepur nallah, 2,100 m (Kashmir), growing in exposed but moist conditions on the calcareous soil along streamlets.

14. *A. ANISOPTERUM* Christ, Bull. Herb. Boiss., 6, 962, 1898; Sledge, Bull. Brit. Mus. (Nat. Hist.) Bot., 2 (11), 289, 1962; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 143, 1964.

Syn.: *Athyrium macrocarpum* Bedd., Ferns South. India, 51, t. 152, 1864 (pro parte).

*Asplenium macrocarpum* var. *atkinsonii* Hook. and Bak., Syn. Fil., 489, 1874; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 489, 1880.

Met with near Chadwick-falls, 1,500 m (Simla); near Kilbri and Pangote, 1,500-1,800 m (Nainital) and near Loharkhet, 2,100 m (Almora). Very common; found growing on damp, shaded and humus rich rocks in the dense forests. Fronds delicate with thin, slender stipe.

15. *A. PROLIFERUM* Moore, Gard. Chr., 778, 1866; Mehra and Dhir, Bull. Bot. Surv. India, 10, 305, 1968.

Quite common at Dalhousie, 2,000 m; Mussoorie, 1,500 m and at Nainital, 1,950 m, growing on humus rich shaded forest floor.

16. *A. PUNCTICAULE* (Bl.) Moore, Ind. Fil., 186, 1860; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 143, 1964.

Bas.: *Aspidium puncticaule* Bl., Enum. Pl. Jav., 159, 1828.

Syn.: *Athyrium macrocarpum* (Bl.) Bedd., Ferns South. India, 51, t. 153, 1864 (excl. t. 152) and Handb. Ferns Brit. India, 165, 1883.

*Asplenium macrocarpum* Bl. in J. Smith Cat. Cult. Ferns, 47, 1857; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 488, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 118, 1902.

Not common; recorded from near Loharkhet, 2,400 m (Almora) and near Jhangi, 2,400 m (Kalpa valley), growing on shaded rocks along the roadsides. Bir (1963) reported it from Simla. Strachey (1906) mentioned Pinder valley as its locality. Characterised by auriculate pinnae, round prominent stipe and rachises and large sori often covering the under-surface.

17. *A. DENTIGERUM* (Clarke) Mehra et Bir, Amer. Fern Jour., 50, 270, 1960; Pichi-Sermolli, Ind. Fil. Suppl., 4, 34, 1965.

Bas.: *Asplenium filix-foemina* var. *dentigera* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 491, 1880.

Syn.: *Athyrium filix-foemina* var. *dentigera* Bedd., Handb. Ferns Brit. India, 169, 1883.

A high altitude fern, found between 2,700-3,000 m altitude. Collected from around Pahlgam, 2,700-3,000 m, Gulmarg, 2,850 m and from near Hemkund, 2,700 m. Bir (1963) reported it from Hattoo, 2,700-3,000 m (Simla).

It prefers to grow in exposed places along water channels. The large elegant fronds growing around an erect rhizome give it a basket like habit.

18. *A. ATKINSONI* Bedd., Ferns Brit. India, Suppl., II, t. 359, 1876 and Handb. Ferns Brit. India, 163, 1883 and Suppl., 32, 1892; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 144, 1964.

Syn.: *Asplenium atkinsoni* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 487, 1880.

A high altitude fern; quite common enroute Hemkund, 2,700 m

(Garhwal), growing on moist shaded and humus rich forest floor along the streamlet. The stipes are densely scaly.

19. *A. FIMBRIATUM* Moore, Ind. Fil. 185, 1860; Bedd., Handb. Ferns Brit. India, Suppl. 37, 1892; Dhir and Datta, Nova Hedwigia, 27, 420, 1976.

Syn.: *A. fimbriatum* Hook., Sp. Fil., 3, 234, 1860; Hope, Jour. Bomb. nat. Hist. Soc., 14, 254, 1902.

*Asplenium andersoni* Clarke, Jour. Linn. Soc., 15, 154, 1876.

*A. atkinsoni* var. *andersoni* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 487, t. 57, 1880.

A common fern of high altitudes generally above 2,700 m. Collected from near Dhakuri, 2,700 m and near Dwali, 3,000 m (Almora). Also reported from Kashmir, 2,850 m and Hattoo peak, 3,000 m (Simla). Prefers to grow on humus rich soil in the dense forests.

20. *A. FOLIOLOSUM* Moore ex Sim., Cat. no. 6, 22, 1859; Bedd., Handb. Ferns Brit. India, Suppl. 37, 1892.

Syn.: *Asplenium foliolosum* Hope, Jour. Bomb. nat. Hist. Soc., 14, 255, 1902.

*A. fimbriatum* Hook. var. *foliolosa* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 495, 1880 (excl. fig.).

*Athyrium fimbriatum* var. *foliolosa* (Clarke) Bedd., Handb. Ferns Brit. India, 172, 1883.

It is a high altitude fern frequently met near Hattoo, 2,900 m (Simla) and Dhakuri pass, 2,850 m (Almora). Also collected from near Pangote, 1,800 m (Nainital). Hope (l.c.) has also found it growing at 1,800 m in Ravi valley.

Always prefers damp, shaded and humus rich soil in dense forests or along the streamlets. Stipe and rachis pink in colour with the lowest secondary pinnule on the superior side, the largest.

21. *A. JAPONICUM* (Thunb.) Copel., Phil. Jour. Soc. Bot., 3C, 290, 1908; Holtt., Fl. Malaya, II, 551, 1954; Dhir and Datta, Nova Hedwigia, 27, 416, 1976.

Bas.: *Asplenium japonicum* Thunb., Fl. Jap., 334, 1784; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 498, 1880 (excl. var. *chattagrammica*); Hope, Jour. Bomb nat. Hist. Soc., 14, 257, 1902.

Syn.: *Diplazium japonicum* (Thunb.) Bedd., Ferns Brit. India, Suppl., 12, 1876 (pro parte), and Handb. Ferns Brit. India, 180, 1883 (not incl. all the synonyms mentioned).

*Lunathyrium japonicum* (Thunb.) Kurata, Jour. Geobot., 9, 99, 1961.

Apparently not common; collected from Lakarmandi-Khajjiar road, 1,800-2,100 m (Dalhousie); Chadwick-falls, 1,500 m (Simla) and near Khati, 2,100 m (Almora). Grows on moist and shaded forest floor where the soil is clayey and humus rich.

Very often it is placed under *Diplazium* (cf. Beddome, 1876, 1883; Stewart, 1942 and 1957). Ching (1964) has made it the type of his genus *Athyriopsis*.

22. *A. THELYPTEROIDES* (Michx.) Desv., Prod., 226, 1827; Bedd., Handb. Ferns Brit. India, 164, 1883; Dhir and Datta, Nova Hedwigia, 27, 415, 1976.

Bas.: *Asplenium thelypteroides* Michx., Fl. bor. Am., 2, 265, 1803; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 488, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 668, 1901.

Syn.: *Athyrium acrostichoides* (Sw.) Diels, Engl. and Prantl, Nat. Pfl., 14, 223, 1899; C. Chr., Ind. Fil., 139, 1905.

Extremely common in Kashmir valley between 2,100-3,000 m altitude. Also collected from Churah forest, 2,400 m (Dalhousie); near Narkanda, 2,700 m (Simla) and enroute Hemkund, 2,000 m (Garhwal).

Prefers damp shaded and humus rich soil along the streamlets. The fronds are densely hairy.

*A. cf. thelypteroides* (Michx.) Desv. Prod. 226, 1827.

Closely allied to *A. thelypteroides*. Collected from Pahlgam-Kolahoi glacier road, 2,700 m (Kashmir), growing on shaded and humus rich soil along the streamlet.

23. *A. DREPANOPTERUM* (Kze.) A. Br., Milde, Fil. Eur., 49, 1867; C. Chr., Ind. Fil. Suppl. 1, 97, 1913; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 142, 1964.

Bas.: *Polypodium drepanopterum* Kze., Linnaea, 23, 278, 318, 1850.

Syn.: *Athyrium oxyphyllum* Moore, Ind. Fil. xlix, 1857; Bedd., Ferns Brit. India, t. 67, 1865, and Handb. Ferns Brit. India, 170, 1883.

*Asplenium oxyphallum* Hook., Sp., Fil., 3, 221, 1860; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 493, 1880.

Rare; reported from Thal, 2,000 m (Kumaon). (Duthie from North Western Himalayas, dated 2.10.1884, sheet no. 3710 in DD).

24. *A. WALLICHIANUM* Ching, Bull. Fan. Mem. Inst. Biol. Bot., 8, 497, 1938.

Syn.: *Nephrodium brunonianum* Hook., Sp. Fil., 4, 251, t. 113, 1862; Clarke Trans. Linn. Soc. Lond., II, Bot., 1,522, 1880.

*Lastrea brunoniana* Presl., Tent. Pterid., 76, 1836 (nomen); Bedd., Handb. Ferns. Brit., India, 246, 1883.

*Dryopteris brunoniana* (Wall. ex Mett.) O. Ktze., Rev. Ge., Pl. 2, 812, 1891; Stewart, Bull. Torrey Bot. Cl., 72, 407, 1945.

A common high level fern with altitudinal range of 3,00-4,200 m. Collected from Khilanmarg, 3,300-3,600 m and enroute Kolahoi and Amarnath, 3,000-3,900 m (Kashmir) where it grows profusely forming large patches in the alpine region.

#### *DRYOATHYRIUM* Ching

1. \**D. BORYANUM* (Willd.) Ching, Bull. Fan. Mem. Inst. Biol., 11, 81, 1941; Sledge, Bull. Brit. Mus. (Nat. Hist.) Bot., 2 (11), 282, 1962; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.),



15, 145, 1964; Bir and Shukla, Bull. Bot. Surv. India, 265, 1966.

Bas.: *Aspidium boryanum* Willd. in Linn., Sp., Ed. 4, v, 285, 1810.

Syn.: *Polypodium subtripinnatum* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 345, 1880.

*Lastrea boryana* (Willd.) Moore, Ind. Fil., 86, 1858; Bedd., Hand. Ferns Brit. India, 266, 1883.

*Phegeopteris Kingii* Bedd., Handb. Ferns Brit. India, Suppl., 84, 1892.

*Athyrium boryanum* (Willd.) Tagawa, Acta Phytotax. et Geobot., 4, 144, 1935; Holtt., Fl. Malaya, II, 567, 1954; Schelpe, Amer. Fern Jour., 44, 58, 32, 1954.

*Cornopteris boryana* (Willd.) Tard., Amer. Fern Jour., 48, 32, 1958.

*Parathyrium boryanum* (Willd.) Holtt., in Kew, Bull., No. 3, 449, 1958.

Reported from the Himalayas from Kangra eastwards between, 1,200-2,700 m. Bir (1963) recorded it from Narkanda, 2,400 m (Simla). Not observed by the author. (Hope from Mussoorie, 1,200 m, dated Oct., 1886, and Duthie from Sarju valley, 900-1,200 m, dated 19.8.1886, sheets in DD).

2. \**D. MACDONELLII* (Bedd.) Morton, Contr. U.S., Nat. Herb., 38 (2), 41, 1967.

Bas.: *Asplenium macdonellii* Bedd., Jour. Bot., 27, 73, 1889; Hope, Jour. Bomb. nat. Hist. Soc., 13, 669, 1901.

Syn.: *Cornopterus macdonellii* Tard., Amer. Fern Jour., 48, 32, 1958.

*Parathyrium macdonellii* Holtt., Kew Bull., 1958, 449, 1959.

Reported from Kashmir and Ravi valley between 1,500-1,800 m. Not observed by the author. (McDonnell from Kashmir, 1,800 m, dated 1894, sheet in CAL; a single sheet without data is lying in DD).

#### DIPLAZIUM Swartz

1. *D. LOBULOSUM* Wall. ex Presl, Tent. Pterid., 114, 1836; Bir and Shukla, Bull. Bot. Surv. India, 8, 271, 1966.

Syn.: *Asplenium longifolium* D. Don, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 478, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 26, 1902.

*Diplazium longifolium* (D. Don) Moore, 1857; Bedd., Handb. Ferns Brit. India, 179, t. 87, 1883.

Not common; found near Punnawala, 2,100 m (Amora) and Chadwick-falls, 1,500 m (Simla), growing on humus rich moist rocks along ravines. Hope (l.c.) reported it from Mussoorie.

2. *D. SPECTABILE* (Wall. ex Mett.) Ching, Lingnan Sc. Jour., 15, 278, 1936; Bir and Shukla, Bull. Bot. Surv. India, 8, 272, 1966.

Bas.: *Asplenium apectabile* Wall. ex Mett., Abhandl. Senck. Naturforsch. Gesell., 3, 240, 1860.

Syn.: *Diplazium umbrosum* var. *multicaudatum* Bedd., Handb. Ferns Brit. India, 190, t. 91, 1883.

*Asplenium multicaudatum* Wall., List no. 229, 1928; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 502, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 263, 1902.

Rare; met with near Snow view, 1,500 m (Nainital) growing on moist, dark, dense forest floor along the water channels. Bir (1963) reported it from Chadwick-falls, 1,500 m (Simla). (Hope from Mossy-falls, Mussoorie, 1,650 m, dated 23.9.1893, sheet in DD).

3. *D. POLYPODIOIDES* Blume, Enum. Pl. Jav., 194, 1828; Bedd., Handb. Ferns Brit. India, 184, t. 89, 1883 (excl. var.); Bir and Shukla, Bull. Bot. Surv. India, 8, 271, 1966; Dhir and Datta, Nova Hedwigia, 27, 423, 1976.

Syn.: *Asplenium polypodioides* Mett., Fil. Lips., 78, 1856; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 501, 1880 (only var. *typica*); Hope, Jour. Boumb. nat. Hist. Soc., 14, 258, 1902.

A large-sized fern; extremely common throughout the Western Himalayas between 1,500-2,400 m growing along water courses in damp and shaded places. Met with near Bakrota and Lakarmandi, 2,400 m (Dalhousie); near Kulu, 1,500 m; around Simla, 1,500-

2,000 m; Mossy-falls, 1,500 m (Mussoorie); near Chamoli, 1,500 m (Garhwal); Bhowali, 1,800 m (Nainital); near Pun nawala, 2,400 m and enroute Pindari, 2,400 m (Almora).

4. \**D. TORRENTIUM* (Clarke) Tard.-Blot., Aspl. du Tonkin, 69, 1932; C. Chr., Ind. Fil., Suppl., III, 77, 1934; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 147, 1964.

Bas.: *Asplenium torrentium* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 500, Pl. 64 (excl. f. 2), 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 258, 1902.

Hope (l.c.) reported it from Chadwick-falls, 1,700 m (Simla).

5. *D. LATIFOLIUM* (D. Don) Moore, Ind. Fil., 144, 1859; Bedd., Handb. Ferns Brit. India, 187, 1883 (pro parte); Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 147, 1964.

Bas.: *Asplenium latifolium* D. Don, Prod., Fl. Nepal., 8, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 502, 1880 (excl. vars.).

Syn.: *Diplazium dilatatum* sensu Bedd., Ferns South. India, t. 162, 1863.

Met with near Gulabkoti, 1,500 m (Garhwal); near Bhowali, 1,650 m and Laria-kanta, 2,400 m (Nainital) and near Loharkhet, 2,400 m (Almora), growing on humus rich, moist but rather exposed forest floor.

6. *D. MAXIMUM* (D. Don) C. Chr., Ind. Fil., 235, 1905; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 147, 1964.

Bas.: *Asplenium maximum* D. Don, Prod. Fl. Nepal., 8, 1825.

Syn.: *Diplazium dilatatum* Blume, Enum. Pl. Jav., 194, 1828.

Locally abundant in the Bhabar forest near Kaladhungi, 600 m (Nainital), growing on damp, shaded and clayey forest floor along a nallah.

7. *D. ESCULENTUM* (Retz.) Sw., Schrad. Jour. Bot., 1801<sup>2</sup>, 312, 1803; Dhir and Datta, Nova Hedwigia, 27, 421, 1976.

Bas.: *Hemionitis esculenta* Retz., Obs., 6, 38, 1791.

Syn.: *Asplenium esculentum* (Retz.) Presl, Rel. Haenk., 1, 45, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 503, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 265, 1902.

*Anisogonium esculentum* Presl, Tent. Pterid., 116, 1836; Bedd., Handb. Ferns Brit. India, 192, t. 94, 1883.

A low level fern; met with near Sat-tal, 1,200 m (Nainital) and near Bageshwar, 900 m (Almora). Also reported from Dehra Dun, 600 m (Mussoorie).

8. \*D. *ASPERUM* Blume, Enum. Plant. Jav., 195, 1828; Bedd., Ferns Brit. India, 184, t. 88, 1883; Bir, Bull. Bot. Surv. India, 4, 5, figs. 11, 15 and 17, 1962.

Syn.: *Asplenium sikkimense* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 500, Pl. 65, f. 1, 1880.

*Athyrium asperum* sensu Holtt., Fl. Malaya, II, 571, 1954 (pro parte).

*Diplazium polypodioides* Bedd., Ferns South. India, t. 163, 1863.

A large-sized fern reported to be common in Churah forest, 2,400 m (Dalhousie) and near Nainital 1,600 m, growing on shaded and humus rich forest floor. Not collected by the author. It is distinguished from *D. polypodioides* by dark-brown densely scaly stipe.

9. D. *SIBIRICUM* (Kze.) Kurata.

Bas.: *Asplenium sibiricum* Kze., Anal. 25, t. 15, 1837.

Syn.: *Athyrium crenatum* (Sommerf.) Rupr., Nayland. Spicil. Ol. fern. 2, 14, 1844.

Collected from Chandanwari, 2,400 m (Kashmir), growing in shaded places along a streamlet. Hope (1902) placed it under *Asplenium squamigerum*, but thought it to be intermediate between *A. squamigerum* and *Athyrium crenatum*. Beddome (1892) identified the Kashmir specimens to be *A. crenatum*. Stewart (1945) also placed it under *Athyrium*.

The present material is identified by Dr. F.M Jarrett (Kew) as *Diplazium sibiricum* (Kze.) Kurata.

10. *D. GIGANTEUM* (Bak.) Ching in C. Chr. Ind. Fil., Suppl., III, 73, 1934.

Bas.: *Gymnogramme gigantea* Bak., JoB, 177, 1889.

Syn.: *Diplazium polymorphum* Presl, Tent. Pterid., 114, 1836 (nomen); Schelpe, Amer. Fern Jour., 44, 52, 1954.

Reported from Manali, 2,100 m, growing on shaded and humus rich forest floor.

Family Thelypteridaceae

*THELYPTERIS* Schmidel

1. *T. REPENS* (Hope) Ching, Bull. Fan. Mem. Inst. Biol., 6, 304, 1936; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 149, 1964; Dhir and Datta, Nova Hedwigia, 28, 138, 1977.

Bas.: *Nephrodium repens* Hope, Jour. Bomb. nat. Hist. Soc., 12, 535, t. 8, 1899.

Syn.: *Dryopteris repens* (Hope) C. Chr., Ind. Fil., 288, 1905.

*Pseudocyclosorus repens* (Hope) Ching, Acta Phytotax. Sinica, 8, 324, 1963.

A low level ravine fern found in Surkhigala, 1,600 m (Dalhousie); near Simla, 1,800 m; Chamoli, 1,350 m (Garhwal); Bhowali, 1,650 m (Nainital) and near Bageshwar, 1,000 m (Amora). Prefers damp, shaded and calcareous soils for luxuriant growth.

2. *T. XYLODES* (Kze.) Ching, Bull. Fan. Mem. Inst. Biol., 6, 296, 1936; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 150, 1964.

Bas.: *Aspidium xylodes* Kunze, Linn. 24, 281, 1851.

Syn.: *Lastrea oethodes* var. *tylodes* Bedd., Ferns South. India, t. 107, 1863 and Handb. Ferns Brit. India, 240, 1883.

*Nephrodium prolixum* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 516, 1880.

*N. xylodes* Hope, Jour. Bomb. nat. Hist. Soc. 14, 724, 1903.

*Pseudocyclosorus xylodes* (Kze.) Ching, Acta Phytotax. Sinica, 8, 324, 1963.

Presently collected from Bhakshu Nath Fall near Dharmasala, 1,600 m (Dalhousie). Also reported from Simla, Mussoorie and Nainital hills between 1,200-1,800 m (G. Watt from Glen, Simla and Mackinnon from North Western Himalayas, 1,200 m, sheets in CAL).

3. *T. SUB-VILLOSA* Ching, Bull. Fan. Mem. Inst. Biol., 6, 197, 1936; Dhir and Datta, Nova Hedwigia, 28, 146, 1977.

Syn.: *Polypodium auriculatum* Wall., List no. 314, 1828 (nomen nudum); Bedd., Ferns Brit. India, t. 203, 1866; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 542, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 15, 78, 1903.

*Phegopteris auriculata* J. Smith, Hist. Fil., 233, 1875; Bedd., Handb. Ferns Brit. India, 290, 1883.

Presently found growing along road-side near Dharamsala, 1,800 m (Dalhousie). Bir (1963) reported it from Simla hills growing in the ravines between 1,500-2,100 m. Stewart (1942) recorded it from around Mussoorie, 2,000 m. (A sheet collected from Mussoorie without data is lying in DD; Mackinnon from Garhwal, 2,400 m, dated 12.10.1904 and Blanford from Simla, 1,350 m, sheets in CAL).

4. *T. BRUNNEA* (C. Chr.) Ching, Bull. Fan. Mem. Inst. Biol., 6, 269, 1936; Dhir and Datta, Nova Hedwigia, 28, 140, 1977.

Bas.: *Dryopteris brunea* C. Chr., Ind. Fil. 255, 1906.

Syn.: *Polypodium distans* D. Don, Prod. Fl. Nepal., 2, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 544, 1880 (pro parte).

*Aspidium palludosum* Bedd., Ferns South. India, t. 168, 1863 (non Raddi, 1825).

*Polypodium late-repens* Trotter apud Hope, Jour. Bomb. nat. Hist. Soc., 12, 628, t. 14, 1899.

*Pseudophegopteris pyrhorhachis* (Kze.) Ching Acta Phytotax. Sinica, 8, 315, 1963.

Very common throughout the Western Himalayas between 1,200-2,700 m altitude. Met with near Tangmarg, 2,100 m, Aru, 2,700 m (Kashmir); near Bathri, 1,500 m (Dalhousie); Kulu, 1,200 m, Chadwick-falls, 1,500 m (Simla); Mossy-falls, 1,500 m (Mussoorie); near Shongtu, 1,200 m and near Jhangi, 2,700 m (Kalpa valley); near Chamoli, 1,200 m (Garhwal); around Nainital, 1,650-2,400 m and Gwaldam, 1,200 m and near Jageshwar, 1,200 m (Almora).

Prefers to grow on exposed sunny slopes along water channels or in damp situations on calcareous gravelly soil. The populations from different localities show a good deal of variation as regards size and cutting of the pinnae. This species complex may be a worthwhile material for detailed investigations. It may, however, be stated that the species is reported to occur in three cytotypes, diploid, tetraploid and hexaploid, although the investigations so far carried out in the Western Himalayas reveal the presence of diploid only.

5. *T. ERUBESCENS* (Wall. ex Hook.) Ching, Bull. Fan. Mem. Inst. Biol., 6, 293, 1936; Dhir and Datta, Nova Hedwigia, 28, 139, 1977.

Bas.: *Polypodium erubescens* Wall. ex Hook., Sp. Fil., 4, 236, 1862; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 543, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 15, 78, 1903.

Syn.: *Phegopteris erubescens* Bedd., Handb. Ferns Brit. India, 289, 1883.

*Dryopteris erubescens* C. Chr., Ind. Fil., 263, 1905.

*Glyphyopteridopsis erubescens* (Hook.) Ching, Acta Phytotax. Sinica, 8, 320, 1963.

A common ravine fern between 900-1.800 m. Collected from Panjpulla, 1,800 m (Dalhousie); Kulu, 1,200 m; Mossy-falls, 1,500 m (Mussoorie) and Rattighat-Bhowali road, 1,350 m - 1,800 m (Nainital).

Grows on moist, shaded and calcareous soil along the streamlets. Sori close to the midrib turning black at maturity.

6. *T. levingii* (Clarke) Ching, Bull. Fan. Mem. Inst. Biol., 6, 273, 1936; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 152, 1964.

Bas.: *Gymnogramme aurita* var. *Levingii* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 568, 1880.

Syn.: *Leptogramme aurita* Hook. var. *levingii* Bedd., Handb. Ferns Brit. India, 377, 1883.

*L. levingii* Bedd., Handb. Ferns Brit. India, Suppl., 99, 1892.

*Dryopteris levingii* (Clarke) C. Chr., Ind. Fil., 275, 1905.

*Pseudophegopteris levingii* (Clarke) Ching, Acta Phytotax. Sinica, 8, 314, 1963.

Occurs on humus rich, shaded and calcareous soil between 1,200-2,700 m. Collected from Tangmarg, 2,700 m and enroute Amarnath, 2,700 m (Kashmir); Shongtu, 1,200 m and near Jhangi, 2,100 m (Kalpa valley); enroute Hemkund, 2,400 m (Garhwal).

7. *T. PALUSTRIS* (Salisb.) Schott., Gen. Fil., adt. 10, 1834; Ching, Acta Phytotax. Sinica, 8, 298, 1963; Mehra and Dhir, Bull. Bot. Surv. India, 10, 306, 1968.

Syn.: *Dryopteris thelypteris* (L.) A. Gray, Man., 630, 1848; Stewart, Bull. Torrey Bot. Cl., 72, 408, 1945.

*Lastrea thelypteris* Bedd., Ferns Brit. India, t. 44, 1876, and Handb. Ferns Brit. India, 241, t. 123, 1883.

*Nephrodium thelypteris* Desv., Clarke, Trans. Linn. Soc., Lond., II, Bot., 1, 517, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 727, 1903.

*Polystichum thelypteris* (L.) Roth, Tent. Fl. Germ., 3, 77, 1799.

Common at Srinagar, 1,800 m (Kashmir), growing in swamps on the clayey soils in exposed conditions.

8. ☆*T. ORNATA* (Wall. ex Bedd.) Ching, Bull. Fan. Mem. Inst. Biol., 6, 346, 1936; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 151, 1964.



Bas.: *Polypodium ornatum* Wall. ex Bedd., Ferns S. India, t. 171, 1863-65; Clarke, Trans. Linn. Soc., Lond., II, Bot., 1, 545, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 15, 81, 1903.

Syn.: *Phegopteris ornata* Bedd., Handb. Ferns Brit. India, 294, t. 152, 1883.  
*Macrothelypteris ornata* (Wall. ex Bedd.) Ching, Acta Phytotax. Sinica, 8, 309, 1963.

Reported from Kumaon below 900 m. Not observed by the author. (Mackinnon from North Western Himalayas, 750 m, dated 8.11.1905, sheet in CAL).

9. ☆*T. CALCARATA* (Blume) Ching, Bull. Fan. Mem. Inst. Biol., 6, 288, 1936.

Bas.: *Aspidium calcaratum* Blume, Enum., 159, 1828.

Syn.: *Nephrodium calcaratum* Hook., Sp. Fil., 4, 93, 1862; Hope, Jour. Bomb. nat. Hist. Soc., 14, 723, 1903.

*Lastrea calcarata* Bedd., Handb. Ferns Brit. India, 235, 1883.

Apparently rare. Reported from near Mussoorie and in Garhwal area at low elevations, 900 m.

10. ☆*T. GRACILESCENS* (Bl.) Ching, Bull. Fan. Mem. Inst. Biol. Bot., 6, 327, 1936.

Bas.: *Aspidium graciliscens* Blume, Enum., 155, 1828.

Syn.: *Nephrodium graciliscens* Hook., Sp., 4, 93, 1862; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 513, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 14, 722, 1903.

*Dryopteris gracilescens* (Bl.) O. Ktze., Rev. Gen. Pl. II, 812, 1891; Stewart, Ferns Muss., 2, 1942.

*Metathelypteris graciliscens* (Bl.) Ching, Acta Phytotax. Sinica, 8, 302, 1963.

Very rare, reported by Hope (l.c.) from Phedi, 1,200-1,500 m (Mussoorie).

11. \**T. ULIGINOSA* (Kze.) Ching, Bull. Fan. Mem. Inst. Biol., 6, 342, 1936; Holtt., Fl. Malaya, II, 241, 1954; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 152, 1964.

Bas.: *Aspidium uliginosum* Kunze in Linnaea, 20, 6, 1847.

Syn.: *Nephrodium tenericaule* Hook., Sp. Fil., 4, 142, 1862 (excl. t. 269); Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 528, 1880.

*Lastrea setigera* Bedd., Ferns Brit. India, Correction, II, 1870 (non Moore, 1858).

*L. tenericualis* Moore, Ind. Fil., 99, 1858; Bedd., Handb. Ferns Brit. India, 266, 1883 (pro parte).

*Dryopteris uliginosa* C. Chr., Ind. Fil., Suppl., III, 100, 1934.

*Macrothelypteris torresiana* (Gaud.) Ching, Acta Phytotax. Sinica, 8, 310, 1963.

Hope (l.c.) reported it from Chamba. No other record from the area.

#### LEPTOGRAMMA J. Smith

1. \**L. TOTTA* J. Smith, Jour. Bot., 4, 52, 1841; Bedd., Handb. Ferns Brit. India, 377, t. 215, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 153, 1964.

Syn.: *Grammitis totta* Presl, Tent. Pterid., 209, t. 9, f. 4, 1836; Bedd., Ferns South. India, t. 49, 1863.

*Dryopteris africana* (Desv.) C. Chr., Ind. Fil., 251, 1905; Stewart, Bull. Torrey Bot. Cl., 72, 409, 1945 and Ferns Muss., 15, 4, 1942.

*Leptogramma africana* (Desv.) Nakai ex Mori, Enum. Pl. Corea, 13, 1922.

Reported from Chamba eastwards between 1,800-2,400 m. Bir (1963) collected it from below Narkanda growing on moist shaded rocks in the ravines. (Many plants collected by Gammie, Hershall, Marten and Lace are lying in DD).

CYCLOSORUS Link

1. *C. DENTATUS* (Forssk.) Ching, Bull. Fan. Mem. Inst. Biol., 8, 206, 1938; Dhir and Datta, Nova Hedwigia, 28, 142, 1977.

Bas.: *Polypodium dentatum* Forssk., Fl. Aegypt., 185. 1775.

Syn.: *Nephrodium molle* sensu Bedd., Handb. Ferns Brit. India, 277, 1883, (pro parte); Hope, Jour. Bomb. nat. Hist. Soc., 14, 746, 1902.

*Christella dentata* (Forssk.) Brownsey and Jermy, Brit. Fern Gaz. 10, 338, 1973.

Extremely common at low altitudes between 450-1,500 m; collected from Panj-pulla khud, 1,500 m (Dalhousie); Kulu, 1,200 m; Chadwick-falls, 1,500 m (Simla); Campty-falls, enroute Jamuna bridge, 1,200 m (Mussoorie); Srinagar, 450 m (Garhwal); Gwaldam, 1,200 m and near Punnawala, 1,200-1,500 m (Almora).

Always prefers moist, shaded and calcareous soil along water courses. Occasionally seen in exposed but damp situations.

2. *C. PAPILIO* (Hope) Ching, Bull. Fan. Mem. Inst. Biol., 8, 214, 1938; Dhir and Datta, Nova Hedwigia, 28, 142, 1977.

Bas.: *Nephrodium papilio* Hope, Jour. Bomb. nat. Hist. Soc., 12, 625, t. 12, 1899.

Syn.: *Nephrodium molle* var. *major* Bedd., Handb. Ferns Brit. India, Suppl., 76, 1892.

*Christella papilio* (Hope) Holtt. in Nayar & Kaur, Companion to Bedd., 208, 1974.

A handsome ravine fern; common in the area between 1,200-1,800 m. Found on way to Bathri, 1,200 m (Dalhousie); Kulu, 1,200 m; Chamoli, 1,200 m (Garhwal); Bhowali-Rattighat road, 1,350 m and Sat-tal, 1,500 m (Nainital); enroute Gwaldam, 1,200 m (Almora).

Grows in moist and shaded conditions on calcareous gravelly soil where the microclimatic changes are well marked.

3. \**C. MOLIUSCULUS* (Kuhn) Ching, Bull. Fan. Mem. Inst. Biol.,

8, 197, 1938; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 154. 1964.

Bas.: *Aspidium molliusculum* Kuhn, Bot. Zeit., 41, 1868.

Syn.: *Nephrodium extensum* var. *microsora* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 530, 1880.

*N. microsorum* (Clarke) Bedd., Handb. Ferns Brit. India, 270, 1883.

Reported from near Bageshwar between 900-1,050 m (Kumaon) and Dehra Dun valley, 350-600 m.

4. *C. ARIDUS* (D. Don) Tagawa, Acta Phytotax. Geobot., 7, 78, May 1938; Ching, Bull. Fan. Mem. Inst. Biol., 8, 194, Sept. 1938; Dhir and Datta, Nova Hedwigia, 28, 141, 1977.

Bas.: *Aspidium aridum* D. Don, Prod. Fl. Nepal., 4, 1825.

Syn.: *Nephrodium aridum* Bak., Syn. Fil., 291, 1874; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 531, 1880; Bedd., Handb. Ferns Brit. India, 272, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 14, 746, 1903.

*Christella arida* (D. Don) Holtt. in Nayar & Kaur, Companion to Beddome, 206, 1974.

Presently collected from Dharamsala, 1,350 m (Dalhousie) growing in shaded and humus rich places along the streamlets. Also reported from around Kulu and Simla between 1,500-1,800 m, Mussoorie and Sarju valley between 450-1,050 m. (Duthie from Mussoorie, Hope from Dehra Dun, 600 m, dated Nov. 1881, sheet in DD).

5. \**C. UROPHYLLUS* (Wall. ex Hook.) Tard. ex Tardieu et C. Chr., Notul. Syst., Paris, 7, 77, 1938.

Bas.: *Polypodium urophyllum* Wall. ex Hook. sp. 5, 9, 1863; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 547, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 15, 81, 1903.

Syn.: *Nephrodium urophyllum* Bedd., Handb. Ferns Brit. India, 274, 1883.

Reported from Garhwal and Kumaon hills between 300-1,500 m.

PRONEPHRIUM Presl

1. *PRONEPHRIUM NUDATUM* (Roxb.) Chandra, Bull. Bot. Surv. India, 13: 274, 1971.

Bas.: *Polypodium nudatum* Roxb., Calcutta Jour. Nat. Hist. 4: 491. 1844.

Syn.: *Nephrodium moulmeinense* Bedd., Handb. Ferns Brit. India, 275, 1883 and Suppl., 73, 1892.

A low altitude fern occurring below 1,500 m. Collected from Chadwick-falls, 1,500 m (Simla); Mossy-falls, 1,500 m (Mussoorie); Chamoli, 1,200 m (Garhwal); Bageshwar, 900 m (Almora).

Grows in exposed, rather moist conditions along streamlets or occasionally along roadsides.

2. \**P. PENANGIANUM* (Hook.) Chandra, Bull. Bot. Surv. India, 13, 274, 1971.

Bas.: *Polypodium penangianum* Hook., Sp. Fil. 5, 13, 1863; Clarke, Trans. Linn. Soc. Lond., II, Bot. 1, 548, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 15, 83, 1903.

Syn.: *Nephrodium costatum* Wall. in Bedd., Handb. Ferns. Brit. India, 275, 1883.

*Cyclosorus penangianus* (Hook.) Copel., Gen. Fil. 143, 1947.

Reported from Jehlum Valley (Kashmir), Chamba and Simla between 1,200-1,650 m.

AMPELOPTERIS Kunze

1. *A. PROLIFERA* (Retz.) Copel., Gen. Fil., 144, 1947; Dhir and Datta, Nova Hedwigia, 28, 143, 1977.

Bas.: *Hemionitis prolifera* Retz., Obs. 6, 38, 1791.

Syn.: *Polypodium proliferum* Roxb., Wall., List no. 312, 1828; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 548, 1880.

*Goniopteris prolifera* Presl, Tent. Pterid., 183, 1836; Bedd., Handb. Ferns Brit. India, 296, t. 153, 1883.

*Cyclosorus proliferus* (Retz.) Tard. ex Tard. et C. Chr., Notul. Syst., Paris, 7, 76, 1938.

Common; collected from Bhabar forest, 300 m and Lal Kuan, 300 m (Nainital) growing on moist shaded clayey soil along water channels.

#### PHEGOPTERIS Fée

1. *P. POLYPODIOIDES* Fée, Gen. Fil., 242, t. 20, A, f. 1, 1850-52; Ching, Acta Phytotax. Sinica, 8, 312, 1963.

Syn.: *Dryopteris phegopteris* (L.) C. Chr., Ind. Fil., 284, 1905; Stewart, Bull. Torrey Bot. Cl., 72, 410, 1945.

*Polypodium phegopteris* Linn., Sp. Pl., 1089, 1753; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 544, 1880.

*Phegopteris vulgaris* Mett., Fil. Lips., 83, 1856; Bedd., Handb. Ferns Brit. India, 290, 1883.

*P. connectilis* (Michx.) Watt, Canad. Nat., 29, 1870.

Restricted to Kashmir valley. Very common on densely shaded humus rich forest floor along the streamlets where diurnal changes are not well marked. Collected from Gulmarg, 2,700 m (Kashmir).

#### GYMNOCARPIUM Newman

1. *G. DRYOPTERIS* (L.) Newm., Phytol., 4, app. 24, 1851.

Bas.: *Polypodium dryopteris* Linn., Sp. Pl., 2, 1093, 1753.

Syn.: *Polystichum dryopteris* (L.) Roth, Tent. Fl. Germ., 3, 80, 1799; Pichi-Sermolli, Ind. Fil. Suppl. IV, 253, 1964.

*Phegopteris dryopteris* Fée, Gen., 243, 1850-52; Bedd., Handb. Ferns Brit. India, 293, 1883.

*Dryopteris linnaeana* C. Chr., Ind. Fil., 275, 1905; Stewart, Bull. Torrey Bot. Cl., 410, 1945.

Met with near Sheshnag enroute Amarnath, 3,900 m (Kashmir) growing in the crevices under the shade of rocks.

2. \**G. ROBERTIANUM* (Hoffm.) Newm., Phytol., 4, app. 24, 1851.

Bas.: *Polypodium robertianum* Hoffm., Dents. Fl., 2, 20, 1795.

Syn.: *Dryopteris robertiana* (Hoffm.) C. Chr., Ind. Fil., 289, 1905.

Collected by Schelpe (1954) from Kangra Himalayas.

Family Aspleniaceae

*ASPENIUM* Linn.

1. *A. ENSIFORME* Wall. ex Hook. and Grev., Ic. Fil., t. 71, 1829; Bedd., Ferns South. India, t. 125, 1863 and Handb. Ferns Brit. India, 141, t. 271, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 476, 1880; Sledge, Bull. Brit. Mus. (Nat. Hist.), 3, (6), 242, 1965; Bir and Shukla, Nova Hedwigia, 16, 471, 1969.

A common epiphyte found growing in the Kumaon hills between 1,800-2,700 m. Collected from Dwali enroute Pindari, 2,100-2,700 m (Almora). It stains the blotting paper deep pink on drying.

2. *A. VIRIDE* Hud., Fl. Angl., 385, 1762; Bedd., Handb. Ferns Brit. India, 143, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 477, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 657, 1901; Stewart, Bull. Torrey Bot. Cl., 416, 1945.

A high altitude species found growing near Khilanmarg, 3,300 m and Sheshnag enroute Amarnath, 3,300-3,900 m. Also seen near Pindari, 3,450 m (Almora). Rare eastwards.

Grows on shaded rocks in the alpine zone. It can be easily mistaken for *A. trichomanes* from which it differs in having sub-

sessile pinnae which are ovate or elliptic with deeply crenate margin.

3. *A. TRICHOMANES* Linn., Sp. Pl., 1080, 1753; Bedd., Handb. Ferns Brit. India, 144, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 477, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 657, 1901; Stewart, Bull. Torrey Bot. Cl., 72, 416, 1945; Dhir and Datta, Nova Hedwigia, 28, 145, 1977.

One of the commonest *Asplenium* species in the Western Himalayas between 1,200-3,300 m. Recorded from Gulmarg, 2,700 m, Pahlgam enroute Kolahoi glacier, 2,200-3,300 m and Tangmarg, 2,100 m (Kashmir); Lakarmandi, 2,400 m (Dalhousie); Kulu, 1,200 m; Glen, 1,800 m (Simla); near Urni, 2,400 m (Kalpa valley); Mossoorie, 2,000 m; Snow-view, 2,100 m (Nainital) and enroute Hemkund, 2,100-3,000 m (Garhwal).

Grows on damp, shaded and humus rich rocks along the roadside and occasionally under the shade of rocks forming humicols. Two cytotypes are known to occur in the Western Himalayas, diploid ( $n = 36$ ) and tetraploid ( $n = 72$ ).

4. *A. SEPTENTRIONALE* (L.) Hoffm., Dents. Fl., 2, 12, 1795; Bedd., Handb. Ferns Brit. India, 145, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 478, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 658, 1901; Stewart, Bull. Torrey Bot. Cl., 72, 416, 1945.

Bas.: *Acrositichum septentrionale* Linn., Sp. Pl. 1068, 1753.

A high altitude grass-like fern occurring above 2,400 m. Collected from Lidderwatt enroute Kolahoi glacier, 3,300 m and Sonamarg, 3,000 m (Kashmir); around Kalpa, 2,700 m. It generally flourishes in the rock crevices or under boulders in moist and shaded conditions but in Kalpa forest it was seen on a big boulder in shaded but rather drier conditions in *Pinus giraridiana* forest. (Harsukh from Lahaul valley, 2,400 m, dated 18.9.1899, sheet no. 14699 in DD).



5. *A. UNILATERALE* Lamk., Encycl., 2, 305, 1786; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 481, 1880; Bedd., Handb. Ferns Brit. India, 152, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 658, 1901; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 157, 1964.

Syn.: *Asplenium resectum* J. Smith, Ic. Pl., 3, t. 72, 1791; Bedd., Ferns South. India, t. 132, 1863.

var. *delicatulum* Par. in Bedd., Handb. Ferns Brit. India, 153, 1883.

Collected from Dhakuri enroute Pindari glacier, 2,400 m (Almora). Hope (l.c.) reported it from Dalhousie. Grows on moist shaded rocks with fronds drooping downwards. The rhizome is wide creeping with distantly placed fronds.

var. *udum* Atk. in Bedd., Handb. Ferns Brit. India, 153, 1883.

Common in Chadwick-falls, 1,500 m (Simla) growing on shaded dark dripping rocks. Rhizome is minute with wiry ebeneous stipes, pinnae smaller than in var. *delicatulum*, transparent, oblique with fimbriate cutting. (Trotter from Kulu, 2,100 m, dated 29.8.1887 in DD).

6. *A. INDICUM* Sledge, Bull. Brit. Mus. (Nat. Hist.), 3 (6), 264, 1965; Dhir and Datta, Nova Hedwigia, 28, 145, 1977.

Syn.: *Asplenium planicaule* Wall., List no. 189, 1828; Bedd., Ferns South. India, t. 139, 1863; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 156, 1964.

*A. laciniatum* var. *planicuale* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 482, 1880.

*A. laciniatum* sensu Bedd., Handb. Ferns Brit. India, 154, 1883 (pro parte), non D. Don.

A common epiphyte between 1,500-2,400 m. Collected from Chadwick-falls, 1,500 m and near Narkanda, 2,400 m (Simla); Bhowali-Rattighat road, 1,500 m (Nainital).

7. *A. LACINIATUM* D. Don, Prod. Fl. Nepal., 8, 1825; Clarke,

Trans. Linn. Soc. Lond., II, Bot., 1, 481, 1880 (pro parte);  
Bedd., Handb. Ferns Brit. India, 1883 (pro parte); Mehra and  
Bir, Res. Bull. Panjab Univ. (N.S.), 15, 157, 1964.

var. *laciniatum* Bedd., Ferns South. India, t. 145, 1863.

Common in Kumaon hills. Collected from Dhakuri enroute Pindari  
glacier, 2,400 m (Almora), growing on moist humus rich rocks.  
Occasionally seen as epiphyte on *Quercus* sp.

8. A. *RUTA-MURARIA* Linn., Sp. Pl., 1081, 1753; Bedd., Handb.  
Ferns Brit. India, 156, 1883 and Handb. Ferns Brit. India,  
Suppl., 30, 1892; Clarke, Trans. Linn. Soc. Lond., II, Bot.,  
1, 482, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 660, 1901;  
Stewart, Bull. Torrey Bot. Cl., 72, 416, 1945.

Not common; collected from Lidderwatt enroute Kolahoi glacier,  
3,300 m and Sonamarg, 2,850 m (Kashmir), growing lithophytical-  
ly on shaded and humus rich boulders and occasionally in the  
crevices of rocks. Fronds 3-6 cm long cut down to the rachis  
into spatulate cuneate pinnules with thick leathery texture;  
sori covering the lower surface.

9. A. *BREYNII* Retz. Stewart, Biologia, 3, 2, 1957.

Reported by Stewart (1957) from Pahlgam, 2,200 m (Kashmir),  
growing on rock boulders.

10. A. *SARELII* Hook. in Blakiston, Yangtze, 363, 364, 1862;  
Stewart, Bull. Torrey Bot. Cl., 72, 417, 1945.

Syn.: *Asplenium pekinense* Hance, Jour. Bot., 5, 262, 1867; Clarke, Trans.  
Linn. Soc. Lond., II, Bot., 1, 483, 1880; Bedd., Handb. Ferns Brit. India,  
156, 1883.

*A. saulii* Baker, Syn. Fil., 216, 1874; Hope, Jour. Bomb. nat. Hist. Soc.,  
13, 661, t. 18 (less dissected form), 1901.

An extremely rare North-West Himalayan fern growing between

600-2,100 m. Collected from Pahlgam, 2,100 m (Kashmir). Bir (1963) reported it from Summer-hill, 2,100 m (Simla).

Grows on moist, shaded and humus rich rocks or boulders in dense forests. It is one of the finely dissected *Asplenium* species with elongated sori which are often confluent; texture is rough, subcoriaceous.

11. *A. CHEILOSORUM* Kunze in Mett., *Aspl.*, 133, no. 104, t. 5, f. 12-13, 1859; Mehra and Bir, *Res. Bull. Panjab Univ. (N.S.)*, 15, 157, 1964; Sledge, *Bull. Brit. Mus. (Nat. Hist.)* 6 (3), 245, 1965.

Syn.: *Asplenium heterosporum* Wall., List no. 218, 1828 (nomen nudum); Clarke, *Trans. Linn. Soc. Lond.*, II, Bot., 1, 481, 1880; Bedd., *Handb. Ferns Brit. India*, 153, t. 77, 1883.

Collected from Gobindghat, 1,800 m (Garhwal), growing on moist shaded rocks in a gorge along the river Ganges. New report for the area.

12. *A. ADIANTUM-NIGRUM* Linn., *Sp. Pl.*, 1081, 1753; Bedd., *Handb. Ferns Brit. India*, 156, 1883; Clarke, *Trans. Linn. Soc. Lond.*, II, Bot., 1, 483, 1880; Hope, *Jour. Bomb. nat. Hist. Soc.*, 13, 661, 1901; Stewart, *Bull. Torrey Bot. Cl.*, 72, 417, 1945.

Common between 1,200-2,700 m. Collected from Tangmarg, 2,100 m, Pahlgam, 2,200 m (Kashmir); Kulu, 1,200 m; near Kanum enroute Pooh, 2,700 m (Kalpa valley) and Loharkhet, 1,500 m (Almora).

Grows on rather dry and shaded forest floor or in the crevices of shaded rocks.

13. *A. FONTANUM* (L.) Bernh., *Schrad. Jour. Bot.*, 1799<sup>1</sup>, 314, 1799; Bedd., *Handb. Ferns Brit. India*, 158, 1883 (excl. var. *exiguum*); Clarke, *Trans. Linn. Soc. Lond.*, II, Bot., 1, 484, 1880; Hope, *Jour. Bomb. nat. Hist. Soc.*, 13, 662, 1901; Stewart, *Bull. Torrey Bot. Cl.*, 72, 417, 1945.

Bas.: *Polypodium fontanum* Linn., Sp. Pl., 1089, 1753.

A high altitude species; collected from Pahlgam, 2,200 m, on way to Lidderwatt, 2,200-3,000 m (Kashmir) and enroute Hemkund, 3,000 m (Garhwal), growing on moist, shaded and humus rich rocks sometimes forming big patches on boulders. The lamina is distinctly bipinnate, pale green with scattered sori.

14. *A. EXIGUUM* Bedd., Ferns South. India, t. 146, 1863; Hope, Jour. Bomb. nat. Hist. Soc., 13, 663, 1901; Stewart, Ferns Muss., 7, 1942.

Syn.: *Asplenium fontanum* Bernh. var. *exiguum* Bedd., Handb. Ferns Brit. India, 158, 1883.

Not common; collected from Mussoorie, 2,000 m and around Nainital between 1,500-2,100 m, growing on exposed ridges in the crevices of rocks. Closely allied to *A. fontanum* from which it can be distinguished in having the rachis often prolonged and rooting at the apex and bipinnatifid lamina with sori close to the costa.

15. *A. varians* Wall. ex Hook. and Grev., Ic. Fil., 2, t. 172, 1829; Bedd., Ferns South. India, t. 129, 1863 and Handb. Ferns Brit. India, 158, 1883; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 485, 1880; Mehra and Bir, Res. Bull. Panjab Univ. (N. S.), 15, 158, 1964.

This is a small-sized fern common throughout the Western Himalayas between 1,500-2,700 m. Recorded from Pahlgam, 2,200 m (Kashmir); Khajjiar, 1,800 m and Kalatop, 2,400 m (Dalhousie); Manali, 2,100 m and on way to Kulu, 1,500 m; Summer-hill, 1,800 m (Simla); Mall-road, 2,000 m (Mussoorie) and around Nainital, 1,800-2,700 m.

Grows on moist shaded rocks or on clayey soil in dense forests. The fronds are oblong-lanceolate, tripinnatifid with herbaceous texture.

16. \*A. *TENUIFOLIUM* D. Don, Prod. Fl. Nepal., 8, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 485, 1880; Bedd., Handb. Ferns Brit. India, 159, t. 78, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 667, 1901; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 158, 1964.

Not common. Hope (l.c.) reported it from around Mussoorie, 1,350 m. (Mackinnon from North Western Himalayas, 1,200-1,350 m, dated 1878, sheet no. 3330, Champion from Nainital, dated 1937, sheet no. 7546 in DD).

17. \*A. *NIDUS* Linn., Sp. Pl., 2, 1079, 1753; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 475, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 459, 1901; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 158, 1964.

Syn.: *Thamnopteris nidus* Presl, Epim. Bot., 68, 1849; Bedd., Handb. Ferns Brit. India, 137, 1892.

Hope (l.c.) has mentioned its occurrence in Garhwal and Kumaon hills between 750-1,200 m. (Duthie from near Askot, 900-1,200 m, dated 1884, sheet no 3631 and from Gori valley, 600-900 m, dated 9.7.1886, sheet no. 6241 in DD; Strachey from Ramganga river, 750 m, dated 1848, sheet in CAL).

18. A. *DALHOUSIAE* Hook., Ic. Pl., t. 105, 1837; Dhir and Datta, Nova Hedwigia, 28, 144, 1977.

Syn.: *Asplenium alternans* Wall., List no. 221, 1828; Bedd., Handb. Ferns Brit. India, 142, 1883; Clarke, Trans. Linn. Soc. Lons., II, Bot., 1, 476, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 13, 460, 1901.

*Ceterachopsis dalhousiae* (Hook.) Ching, Bull. Fan. Mem. Inst. Biol. Bot., 10, 9, 1940.

*Ceterach dalhousiae* (Hook.) C. Chr., Ind. Fil., 170, 1905; Stewart, Bull. Torrey Bot. Cl., 72, 417, 1945.

Common throughout the Western Himalayas between 900-2,700 m. Recorded from Pahlgam, 2,200 m (Kashmir); Bathri, 900 m and Dainkund, 2,700 m (Dalhousie); Kulu, 1,200 m; Chhrabra, 2,400 m

and Rampur 900 m (Simla); Jhangi, 2,100 m (Kalpa valley); Chamel's back road, 1,800 m (Mussoorie); Bhowali-Rattighat road, 1,200-1,800 m and Cheena peak, 2,400 m (Nainital) and Loharkhet, 1,500 m (Almora).

The species has been observed growing in a variety of habitats, i.e., on the banks of streamlets, in moist and shaded places but flourished in the crevices of rocks or masonry works. Rarely seen as foot epiphyte also.

#### *CETERACH* Garsault

1. *C. OFFICINARUM* DC in Lam. and DC, Fl. Fr., 2, 566, 1805; Stewart, Bull. Torrey Bot. Cl., 72, 418, 1945.

Syn.: *Asplenium ceterach* Linn., Sp. Pl., 1080, 1753; Hope, Jour, Bomb. nat. Hist. Soc., 14, 265, 1902; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 504, 1880.

*Hemidictyum ceterach* (L.) Bedd., Handb. Ferns Brit. India, 194, 1883.

Common in Western Himalayas between 1,200-2,400 m. Recorded from Kulu, 1,200 m; Nishat gardens, 1,800 m (Kashmir); Tapri-Urni road, 1,800 m (Kalpa valley) and near Bharari, 1,200 m (Almora).

Grows in rather exposed situations sometimes in the crevices of rocks. The present observations extend its distribution to Kumaon hills.

#### Family Blechnaceae

#### *BLECHNUM* Linn.

1. \**B. ORIENTALE* Linn., Sp. Pl., 2, 1077, 1753; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 474, 1880; Bedd., Handb. Ferns Brit. India, 132, t. 66, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 459, 1901; Mehra, Ferns Muss., 21, 1939; Bir, Bull. Bot. Surv. India, 5, 153, 1963.

Very rare, Hope (l.c.) reported it from Mussoorie hills at 1,200 m. Recently Bir (l.c.) found one individual near Narkanda growing in rather exposed situations. (Mackinnon from Bhatoli, Garhwal, 900-1,200 m, dated Sept., 1904, sheet in CAL).

#### WOODWARDIA Smith

1. *W. RADICANS* (L.) Smith, Mem. Ac. Turin., 5, 412, 1793; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 475, 1880; Bedd., Handb. Ferns Brit. India, 135, t. 68, 1883; Hope, Jour. Bomb. nat. Hist. Soc., 13, 459, 1901; Dhir and Datta, Nova Hedwigia, 28, 146, 1977.

Bas.: *Blechnum radicans* Linn., Mant., 307, 1771.

Quite common in the Western Himalayas between 1,200-2,400 m. Recorded from Benikhet, 1,500 m and Bakrota, 2,400 m (Dalhousie); Kulu, 1,200 m; Chadwick-falls, 1,500 m (Simla); Mossy-falls, 1,500 m (Mussoorie); Kilbri road, 2,100 m (Nainital) and Khati enroute Pindari, 2,400 m (Almora).

Fronde are often seen hanging from rocky walls of streams. Also met along the roadside in moist and shaded places. Terminal or subterminal buds on fronds frequently observed rooting.

Family Loxogrammeaceae

#### LOXOGRAMME (Blume) Presl

1. *L. INVOLUTA* (D. Don) Presl, Tent. Pterid., 215, 1836; Bedd., Handb. Ferns Brit. India, 393, t. 228, 1883; Sledge, Bull. Brit. Mus. (Nat. Hist.), 2, (5), 142, 1960; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 160, 1964.

Bas.: *Grammitis involuta* D. Don, Prod. Fl. Nepal., 14, 1825.

Syn.: *Gymnogramme involuta* Hook., Sp. Fil., 5, 155, 1864; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 570, 1880.

Not common. Collected from Nainital, 2,400-2,700 m and Mussoorie, 2,100 m.

2. *L. LANCEOLATA* Presl, Tent. Pterid., 215, t. 9, f. 8, 1836; Bedd., Handb. Ferns Brit. India, 393, 1883; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 161, 1964.

Syn.: *Gymnogramma lanceolata* Hook., Sp. Fil., 5, 156, 1864; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 570, 1880.

Rare, collected from Khati-Dwali road at about 2,400 m (Almora), growing as epiphyte in the dark shaded forest. Recorded for the first time from the Western Himalayas.

Family Polypodiaceae

#### *PYRROSIA* Mirbel

1. *P. MOLLIS* (Kze.) Ching, Bull. Chinese Bot. Soc., 1, 53, 1935; Sledge, Bull. Brit. Mus. (Nat. Hist.), 2 (5), 134, 1960; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 163, 1964.

Bas.: *Niphobolus fissus* Bedd., Ferns Brit. India, Collection II, 1870 and Handb. Ferns Brit. India, 330, t. 179, 1883 (non Blume, 1828).

*N. porosus* Bedd., Ferns South. India, t. 183, 1863.

*Polypodium fissum* Bak., Syn. Fil., 351, 1867; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 554, 1880.

Found in Garhwal and Kumaon hills between 900-1,800 m. Collected from Gobindghat, 1,800 m (Garhwal); Mangoli-Kaladhungi road, 900 m (Nainital) and near Jageshwar, 1,800 m (Almora).

Grows on shaded rocks in somewhat dry conditions. Frequently seen as epiphyte on tree-trunks. The frond is heavily covered on the under-surface with dark-brown indumentum consisting of two kinds of hair.

2. *P. MANNII* (Gies.) Ching, Bull. Chinese Bot. Soc., 1, 55,



1935; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 163, 1964.

Bas.: *Niphobolus manni* Gies., Farngett. Niphobolus, 107, 1901.

Syn.: *Niphobolus fissus* Hook., Sp. Fil., 5, 48, 1863; Bedd., Handb. Ferns Brit. India, 330, 1883, pro parte (non Blume, 1828).

*N. floccigerus* Bedd., Ferns Brit. India, Suppl., 22, t. 386, 1876.

Not common, observed along Mangoli-Kaladhungi road, 1,200 m (Nainital) growing as an epiphyte on broad-leaved trees.

3. *P. FLOCCULOSA* (D. Don) Ching, Bull. Chinese Bot. Soc., 1, 66, 1935; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 164, 1964.

Bas.: *Polypodium flocculosum* D. Don, Prod. Fl. Nepal., 1, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 554, 1880.

Syn.: *Niphobolus flocculosus* Bedd., Ferns Brit. India, t. 162, 1866; and Handb. Ferns Brit. India, 331, t. 180, 1892.

A common epiphyte of Kumaon hills between 500-1,500 m. Recorded from Kathgodam, 500 m, Bhimtal, 1,200 m, Mangoli, 1,500 m and Sat-tal, 1,500 m (Nainital) in Kumaon hills. Stipes subcaespitose, lamina oblong-lanceolate with dimorphous hairs.

4. *P. PANNOSA* (Mett. ex Kuhn) Ching, Bull. Chinese Bot. Soc., 1, 58, 1935; Sledge, Bull. Brit. Mus. (Nat. Hist.), 2, (5), 135, 1960; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 164, 1964.

Bas.: *Polypodium pannosum* Mett. apud Kuhn in Linnaea, 36, 141, 1869.

Syn.: *Niphobolus pannosus* (Mett.) Bedd., Ferns Brit. India, Suppl., 22, 1876, and Handb. Ferns Brit. India, 328, t. 177, 1883.

*N. lingua* Bedd., Ferns South. India, t. 240, 1863 (non Spring, 1827).

Very rare; collected from near Bhimtal, 1,350 m (Nainital). A new record for the area.

5. \**P. ADNASCENS* (Sw.) Ching, Bull. Chinese Bot. Soc., 1, 45, 1935; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 161, 1964.

Bas.: *Polypodium adnascens* Sw., Syn. Fil., 25, 222, t. s, f. 2, 1806; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 552, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 15, 87, 1903.

Hope (l.c.) reported it from Garhwal, 900-1,200 m and in Sarju valley, 1,050 m (Almora). (Inayat from Kapkot (Almora), dated 29.7.1900, sheet no. 25064; Mackinnon from Garhwal, dated April 1881, Duthie from Ramganga valley, dated 30.10.1884, sheet no. 3696 in DD; Mackinnon from Garhwal, 900-1,200 m, dated April, 1881, Inayat from Kapkot, dated 30.7.1900, sheet no. 25063, Sen Gupta from Happy valley, dated 17.5.1958, sheet no. 2014, growing on bark covered with Algae and Lichens, in CAL).

6. \**P. STIGMOSA* (Sw.) Ching, Bull. Chinese Bot. Soc., 1, 67, 1935; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 164, 1964.

Bas.: *Polypodium stigmosum* Swartz, Schrad. Jour., 1800<sup>2</sup>, 21, 1801; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 553, 1880 (pro parte); Hope, Jour. Bomb. nat. Hist. Soc., 15, 88, 1903.

Syn.: *Niphobolus stigmosus* Bedd., Handb. Ferns Brit. India, 328, t. 178, 1883.

Hope (l.c.) reported it from Garhwal, 1,200 m and Sarju valley, 900-1,500 m (Almora). (Duthie from Garhwal, dated Oct. 1881, Inayat from Kapkot (Almora), dated 30.7.1900, sheet no. 25047 in DD; Strachey from near Bageshwar, 900 m, dated 1848, Mackinnon from Garhwal, 1,200 m, dated Nov. 1878 in CAL).

#### *POLYPODIUM* Linn.

1. *P. AMOENUM* Wall. ex Mett., Pol. 80, n. 131, 1857; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 550, 1880; Ching, Ic.

Fil. Sinicarum, 2, Pl. 99, 1934; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 166, 1964.

Syn.: *Goniophlebium amoenum* J. Smith in Hook., Gen. Fil., ad. t. 51, 1840; Bedd., Handb. Ferns Brit. India, 317, 1883.

Very common throughout the Western Himalayas except Kashmir valley, between 1,500-2,400 m. Collected from Bakrota, 2,400 m and Panj-pulla, 1,800 m (Dalhousie); Vashist, 2,100 m (Manali); around Simla, 1,800-2,400 m; Jabarkhet, 2,400 m (Mussoorie); Tiffon top, 2,250 m, Snow view, 2,000 m and Laria-kanta, 2,400 m (Nainital) and near Jageshwar, 1,800 m (Almora).

Grows as an epiphyte on the moss-laden tree trunks or inhabits the moist rocks along roadsides in densely shaded places.

var. *xerophyticum* Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 166, 1964.

Grows epiphytically on the ridge near Snow view, 2,100 m (Nainital). Not common.

var. *pinnatifida* var. nov.

Rhizome wide-creeping, stout; scales sub-adpressed, pale-brown, thin, clathrate with a broad base drawn out to an acuminate apex, margin almost smooth; stipes far apart, stramineous brown, naked, 20-30 cm long, adaxial groove present; fronds erect, yellowish brown when dry, 50-65 cm long; lamina pinnatifid nearly to the rachis, 30-35 cm long, 15-20 cm broad, ovate-lanceolate, apex acuminate; pinnae 20 or more pairs with acuminate apex, 8-10 cm long, further pinnatifid to the middle of the segment, horizontal or ascending with lower 1-2 pairs deflexed downwards; texture herbaceous, scales on rachis and rachislets of pinnatifid pinnules beneath, slightly pilose on both sides; veins distinct on both surfaces, areolae uniseriate along the costae of the pinnae and pinnatifid pinnules, soriferous; sori globose, sunk, nearer to the costa than to the margin, paraphysate; sporangium with 12-15 celled annulus; spores globose, yellowish and smooth walled.

Common along Loharkhet-Dhakuri road enroute Pindari, 2,700 m

(Almora), growing on moist, humus rich but rather exposed rocks along a streamlet.

Holotype: Acc. no. 670, Isotype: Acc. no. 6704, in PAN.

2. *P. SUBAMOENUM* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 550, Pl. 82, f. 2, 1880; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 167, 1964.

Syn.: *Goniophlebium subamoenum* Bedd., Handb. Ferns Brit. India, 317, 1883.

Not common; recorded from Khati-Dwali road, 2,400 m (Almora) growing on humus rich rocks. Also reported from Churah forest, 1,800-2,400 m (Dalhousie).

3. *P. MICRORHIZOMA* Clarke ex Baker in Hook. and Bak., Syn. Fil., Ed. 2, 511, 1874; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 551, 1880; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 167, 1964.

Bas.: *Goniophlebium microrhizoma* Bedd., Ferns Brit. India, Suppl., 21, t. 384, 1876, and Handb. Ferns Brit. India, 322, 1883.

Exceedingly common epiphyte in Kalatop forest, 2,400 m (Dalhousie), around Simla, 1,500-2,400 m; Camel's back, 1,800 m (Mussoorie); Gobindghat, 1,800 m (Garhwal); Land's end, 2,100 m, Snow view, 2,100 m and Cheena peak, 2,400 m (Nainital). Frequently seen as lithophyte in all the forests of the area.

var. *xerophytica* Mehra, Ferns Muss., 22, 1939.

Mehra (l.c.) reported it from Mussoorie hills. Not observed by the author.

4. \**P. aff. MICRORHIZOMA* Clarke ex Baker in Hook. and Bak., Syn. Fil., Ed. 2, 511, 1874.

Schelpé (1954) reported it from the coniferous plantations around Manali growing on the boulders and rockwalls.

5. *P. LACHNOPUS* Wall. ex Hook., Ic. Pl., t. 952, 1854; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 551, 1880; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 167, 1964.

Syn.: *Goniophlebium lachnopus* J. Smith in Hook., Gen., ad., t. 51, 1840; Bedd., Handb. Ferns Brit. India, 319, 1883.

Epiphytic or lithophytic; exceedingly common between 1,200-2,100 m, especially near Benikhet, 1,500 m (Dalhousie); Mossy-falls, 1,500 m (Mussoorie); Land's end, 2,100 m, Nainital-Bhowali road, 1,800 m (Nainital). Similar to *Polypodium micro-rhizoma* in habit and habitat but hair pointed black fibrillose scales on the rhizome differentiate it from the aforesaid species.

var. *xerophytica* Mehra, Ferns Muss., 22, 1939.

Reported by Mehra (l.c.), growing as an epiphyte on trees or on calcareous rocky soil along the ridges on Dhanolti-Kaudia road (Mussoorie).

5. *P. ARGUTUM* Wall. ex Hook., Sp. 5, 52, 1863; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 551, 1880; Mehra and Bir, Res. Bull. Panjab Univ. (N.S.), 15, 167, 1964.

Syn.: *Goniophlebium argutum* (Wall.) J. Smith in Hook., Gen. Fil., ad. t. 15, 1840; Bedd., Handb. Ferns Brit. India, 323, 1883.

Not common; occasionally seen between 1,800-2,700 m. Recorded from Narkanda enroute Hattoo, 2,700 m (Simla); on way to Laria-kanta, 2,200 m and Kilbri, 2,400 m (Nainital). Grows epiphytically on thickly moss-laiden tree trunks on the ridges showing pendant habit. Occasionally occurs as lithophyte along roadside.

#### *LEPISORUS* (J. Smith) Ching

1. *L. EXCAVATUS* (Bory) Ching, Bull. Fan. Mem. Inst. Biol., 4, 68, 1933.

Bas.: *Polypodium excavatum* Bory ex Willd., Sp. Pl., 5, 158, 1810.

Syn.: *Pleopeltis simplex* Bedd., Handb. Ferns Brit. India, 347, 1883.

*Polypodium lineare* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 558, 1880, pro parte.

One of the commonest species of *Lepisorus* occurring throughout the Western Himalayas between 1,500-3,000 m; abundant in Lidderwatt forest, 3,000 m (Kashmir); Kalatop forest, 2,400 m (Dalhousie); Manali, 2,000 m; around Simla, 1,800-2,100 m; Jabarkhet, 2,100 m (Mussoorie) and around Nainital, 1,500-2,400 m.

Exceedingly common epiphyte covering the tree trunks and usually associated with *Polypodium microrrhizoma* and *Araiostegia pseudocystopteris* (Fig. 2). Also grows as lithophyte on moist and shaded walls.

var. *mortonianus* Bir & Trikha, Amer. Fern Jour., 64, 56, 1974.

Bir & Trikha (l.c.) reported from near Tiffon Top, 2,250 m (Nainital).

var. *himalayensis* Bir & Trikha, Amer. Fern Jour., 64, 58, 1974.

Reported from Cheena Peak, 2,400 m (Nainital).

2. *L. LEIOPTERIS* (Kze.) Bir & Trikha, Amer. Fern Jour., 64, 54, 1974.

Bas.: *Polypodium leiopteris* Kunze, Linnaea 23, 279, 319, 1850.

Syn.: *Lepisorus exclavatus* (Bory) Ching var. *scolopendrium* (D. Don) Ching, Bull. Fan. Mem. Inst. Biol., 4, 69, 1933.

*Pleopeltis scolopendrium* (D. Don) Alston & Bonner, Candollea, 15, 207, 1956.

Not common; occurs in Kumaon hills between 1,800-2,400 m. Found growing as an epiphyte near Tiffon top, 1,800 m and Cheena peak, 2,400 m (Nainital).

3. *L. OLIGOLEPIDUS* (Baker) Ching, Bull. Fan. Mem. Inst. Biol., 4, 80, 1933; Bir & Trikha, Amer. Fern Jour. 64, 50, 1974.

Bir & Trikha (l.c.) reported it from Mussoorie, 1,500 m, growing along a stream.

4. *L. SUBOLIGOLEPIDUS* Ching, Bull. Fan. Mem. Inst. Biol., 4, 77, 1933; Bir & Trikha, Amer. Fern Jour., 64, 52, 1974.

Stewart in Bir & Trikha (l.c.) reported it from enroute Sonamarg, 1,500 m (Kashmir).

5. *L. KUCHENENSIS* (Wu) Ching, Bull. Fan. Mem. Inst. Biol., 4, 69, 1933 and Ic. Fil. Sinicarum, 2, Pl. 64, 1934; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 168, 1964.

Bas.: *Polypodium kuchenensis* Wu in Wu et al., Polypod. Yaoshan., 276, t. 129, 1932.

Not common; collected from Laria-kanta forest, 2,400 m (Nainital), growing as an epiphyte. The rhizome grows superficially with stiff wiry roots. Closely allied to *L. excavatus*, but differs in herbaceous pale green fronds and sori not punctate on the upperside. New record for the area.

6. *L. KASHYAPII* (Mehra) Mehra in Bir, Res. Bull. Panjab Univ. (N.S.), 13, 24, 1962.

Bas.: *Polypodium kashyapii* Mehra, Ferns Muss., 24, 1939.

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

Very common in Nainital and Mussoorie hills between 1,500-2,700 m. Occasionally met with in Simla hills between 1,800-2,400 m.

Always grows as an epiphyte on moist and humus rich tree trunks. The fronds turn brown on drying.

7. *L. NUDUS* (Hook.) Ching, Bull. Fan Mem. Inst. Biol., 4, 83, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 169, 1964.

Bas.: *Pleopeltis nuda* Hook., Exot. Fl., 1, t. 63, 1823; Alston & Bonner, Candollea, 15, 208, 1936; Sledge, Bull. Brit. Mus. (Nat. Hist.), 2 (5), 135, 1960.

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

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

*Polypodium lineare* sensu Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 558, 1880 (pro parte); Hope, Jour. Bomb. nat. Hist. Soc., 15, 90, 1903.

Not common; sometimes seen growing as an epiphyte in the Kumaon hills. The rhizome scales are ovate, acute, concolorous, brown and entire-margined.

8. *L. THUNBERGIANUS* (Kaulf.) Ching, Bull. Fan Mem. Inst. Biol., 4, 88, 1933; and Ic. Fil. Sin., 2, 76, 1934.

Bas.: *Pleopeltis thunbergiana* Kaulf., Wesen. d. Farrnke. 113, 1827.

Common; found growing as a lithophyte between 1,800-2,100 m on exposed rocky walls along the roadsides. It is markedly distinguishable from *L. nudus* in having subulate-lanceolate, long-acuminate, ciliate-dentate and black rhizome scales.

9. *L. AMAUROLEPIDUS* (Sledge) Bir & Trikha in Bir & Vasudeva, Jour Bomb. Nat. Hist. Soc., 68, 192, 1971, var. *longifolius* Bir & Trikha, Amer. Fern Jour., 64, 63, 1974.

Bir & Trikha (l.c.) reported from Ranikhet, 900-1,200 m (Nainital) growing on rocks along bridal path.

10. *L. CONTORTUS* (Christ) Ching, Bull. Fan Mem. Inst. Biol., 4, 90, 1933 and Ic. Fil. Sin., 2, Pl. 75, 1934.

Bas.: *Polypodium contortum* Christ, Bot. Gaz., 51, 347, 1911.



Syn.: *Polypodium lineare* var. *thunbergianum* f. *contorta* Takeda, Notes, R. Bot. Gard. Edinb., 8, 270, 1915.

Common at high altitudes in Kumaon and Garhwal hills. Collected from near Hemkund, 3,000 m and around Badrinath, 2,700 m (Garhwal) growing on exposed boulders. It can be readily separated from the preceding species in having rhizome scales ovate-acuminate, rufo-brown, dentate with elongate clear cells except the thick-walled central zone and sori ovate or oblong.

11. *L. LORIFORMIS* (Wall. ex Mett.) Ching, Bull. Fan Mem. Inst. Biol., 4, 81, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 159, 1964.

Bas.: *Polypodium loriforme* Wall. ex Mett., Pol. 92, n. 164, 1857; Schelpe, Amer. Fern Jour., 44, 58, 1954.

Syn.: *Pleopeltis linearis* sensu Bedd., Handb. Ferns Brit. India, 346, 1883 (pro parte).

*Polypodium lineare* var. *steniste* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 559, 1880.

Not common; found at one place enroute Badrinath, 2,400 m. Grows as lithophyte on moss-laden, moist and shaded rocks.

The fronds are linear-elongate, subcoriaceous and brown in colour with rounded-oblong submarginal sori.

12. *L. CLATHRATUS* (Clarke) Ching, Bull. Fan Mem. Inst. Biol., 4, 71, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 169, 1964.

Bas.: *Polypodium clathratum* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 539, Pl. 82, f. 1, 1880.

Syn.: *Pleopeltis clathrata* (Clarke) Bedd., Handb. Ferns Brit. India, 348, 1883.

A common epiphyte between 1,500-3,000 m altitude, abundant at

Bakrota, 2,400 m (Dalhousie), enroute Hattoo, 2,700 m (Simla); in Hemkund forest, 3,000 m (Garhwal); in Mangoli forest, 1,500 m (Nainital) and near Dwali enroute Pindari, 3,000 m (Almora). Occasionally grows as lithophyte along roadsides.

The fronds are long, linear with thin herbaceous texture, conspicuous venation and long stipes.

13. \**L. BICOLOR* (Takeda) Ching, Bull. Fan Mem. Inst. Biol., 4, 66, 1933.

Bas.: *Polypodium excavatum* var. *bicolor* Takeda, Notes, R. Bot. Gard. Edinb., 8, 279, 1915; C. Chr., Contr. U.S. Nat. Herb., 28, 319, 1931.

Syn.: *Polypodium bicolor* (Takeda) Alston ex Schelpe, Amer. Fern Jour., 44, 59, 1954.

Schelpe (l.c.) reported it from Kangra valley.

#### PHYMATODES Presl

1. *P. HASTATA* (Thunb.) Ching, Sinensia, 3, 344, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 170, 1964.

Bas.: *Polypodium hastatum* Thunb., Fl. Jap., 335, 1784; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 562, 1880.

Syn.: *Pleopeltis hastatus* Moore, Ind. Fil., 346, 1862; Bedd., Handb. Ferns Brit. India, 362, t. 205, 1883 (pro parte).

*Crypsinus hastatus* (Thunb.) Copel., Gen. Fil., 206, 1947.

A common lithophyte between 1,000-1,500 m; plentiful near Bhowali, 1,500 m (Nainital) and in Loharkhet forest, 1,000 m (Almora) growing on shaded and moist rocks along roadsides.

2. *P. OXYLOBA* (Wall. ex Kze.) Presl, Tent. Pterid., 196, 1836; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 171, 1964.

Bas.: *Polypodium oxylobum* Wall. ex Kunze, Linnaea, 24, 255, 1851.

Syn.: *Pleopeltis hastata* sensu Bedd., Handb. Ferns Brit. India, 362, 1883 (pro parte).

*Polypodium hastatum* var. *oxyloba* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 563, 1880 (pro parte).

*Crypsinus oxylobus* (Wall. ex Kze.) Sledge, Bull. Brit. Mus. (Nat. Hist.), 2, 145, 1960; Nishida, Jour. Coll. Arts Sci., Chiba Univ., 4, 579, 1966.

Not common; collected from Nainital, 1,800 m growing in rather dry conditions. Rhizome short prostrate with ferruginous scales.

(Strachey from above Jageshwar, 1,950 m, Mackinnon from Mussoorie, 1,350-1,950 m, dated 1878/1879, Duthie from Ganges valley, 2,100-2,400 m, dated Sept. 1881, sheets in CAL).

3. *P. STEWARTII* (Bedd.) Ching, Contrib. Inst. Bot. nat. Acad. Peiping, 2, 81, 1933; Mehra and Bir, Res. Bull., Panjab Univ. (N.S.), 15, 171, 1964.

Bas.: *Pleopeltis stewartii* Bedd., Ferns Brit. India, t. 204, 1866.

Syn.: *Pleopeltis malacodon* var. *majus* Bedd., Handb. Ferns Brit. India, 363, 1883.

*Polypodium cyrtolobum* Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 563, t. 83, 1880.

*Crypsinus stewartii* (Bedd.) Copel., Gen. Fil., 206, 1947.

Not common; met with in Dhakuri forest, 2,800 m (Almora) and Bhowali, 1,500 m (Nainital) where it covers humus rich rather exposed rocks along streamlets. Bir (1963) reported it from Hattoo and Shali peaks (Simla hills).

(Mackinnon from Park hill, Mussoorie, 1,950 m, dated 17.8.1898, sheet in CAL).

4. *P. STRACHEYI* Ching, Contr. Inst. Bot. nat. Acad. Peiping, 2, 83, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 172, 1964.

Syn.: *Polypodium stewartii* Clarke, Trans. Linn. Soc. Lon., II, Bot., 1, 563, 1880 (non Bedd. 1866); Hope, Jour. Bomb. nat. Hist. Soc., 15, 96, 1903.

Very rare, a few individuals were found in Dhakuri forest, 2,800 m, growing on the rocks and tree trunks along streamlets.

5. *P. MALACODON* (Hook.) Ching, Contr. Inst. Bot. nat. Acad. Peiping, 2, 83, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N. S.), 15, 172, 1964.

Bas.: *Polypodium malacodon* Hook., Sp. Fil., 5, 87, 1863; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 564, 1880.

Syn.: *Pleopeltis malacodon* Bedd., Handb. Ferns Brit. India, 363, 1883 (pro parte), non *P. malacodon* Bedd., Ferns Brit. India, Suppl., 23, t. 387, 1876.

*Crypsinus malacodon* (Hook.) Copel., Gen. Fil., 206, 1947.

This is a high altitude species found near Hattoo, 3,000 m (Simla) and enroute Hemkund, 3,300 m (Almora) growing as a lithophyte on exposed rocks. Also found as an epiphyte.

6. *P. EBENIPES* (Hook.) Ching, Contr. Inst. Bot. nat. Acad. Peiping, 2, 86, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N. S.), 15, 170, 1964.

Bas.: *Polypodium ebenipes* Hook., Sp. Fil., 5, 88, 1863; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 564, 1880 (excl. vars.).

Syn.: *Pleopeltis ebenipes* Bedd., Ferns Brit. India, t. 138, 1866, and Handb. Ferns Brit. India, 363, 1883.

*Crypsinus ebenipes* (Hook.) Copel., Gen. Fil., 206, 1947.

Not common; reported by Bir (1963) from Shali, 3,000-3,150 m (Simla). Recently, Bir & Devi (1968) have placed the West Himalayan individuals under the var. *abenipes*.

(Mackinnon from Nag-tiba, 2,700 m, dated Aug. 1878, Gamble from Jaunsar, 2,550 m, dated Sept. 1898, sheet no. 27274 in CAL).

7. *P. ERYTHROCARPA* (Mett. ex Kze.) Ching, Contr. Inst. Bot. nat. Acad. Peiping, 2, 80, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 171, 1964.

Bas.: *Polypodium erythrocarpum* Mett. ex Kunze, Linnaea, 36, 135, 1869; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 565, 1880.

Syn.: *Goniophlebium erythrocarpum* Bedd., Ferns Brit. India, Suppl., 27, t. 382, 1876, and Handb. Ferns Brit. India, 319, t. 171, 1883.

Rare; reported from Hattoo, 3,000 m (Simla).

#### ARTHROMERIS J. Smith

1. *A. WALLICHIANA* (Spr.) Ching, Contr. Inst. Bot. nat. Acad. Peiping, 2, 92, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 173, 1964.

Bas.: *Polypodium wallichianum* Spr., Syst., 4, 53, 1827.

Syn.: *Pleopeltis juglandifolia* Moore, Ind. Fil., 78, 1857; Bedd., Handb. Ferns Brit. India, 368, 1892.

*Polypodium juglandifolium* D. Don, Prod. Fl. Nepal., 3, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 566, 1880.

A common epiphyte or lithophyte between 1,800-2,700 m, especially in Jabarkhet forest, 2,400 m (Mussoorie) and Loharkhet en-route Pindari, 1,800-2,200 m (Almora).

2. *A. LEHMANNI* (Mett.) Ching, Contr. Inst. Bot. Acad. Peiping, 2, 96, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 173, 1964.

Bas.: *Polypodium lehmanni* Mett., Pol., 117, no. 229, t. 3, f. 35, 1857; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 566, 1880.

Syn.: *Pleopeltis lehmanni* Bedd., Ferns Brit. India, t. 260, 1868, and Handb. Ferns Brit. India, 370, t. 211, 1883.

Rare; collected from Dhakuri Forest, 2,700 m (Almora), growing as an epiphyte on moss-laden tree trunks.

COLYSIS Presl

1. ☆*C. ELLIPTICA* (Thunb.) Ching, Bull. Fan Mem. Inst. Biol., 4, 333, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 174, 1964.

Bas.: *Polypodium ellipticum* Thunb., Fl. Jap., 335, 1784.

Syn.: *Selliguea elliptica* Bedd., Handb. Ferns Brit. India, 392, t. 227, 1883 (pro parte).

*Gymnogramma elliptica* Hook. & Bak., Syn. Fil., 389, 1874; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 570, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 15, 102, 1903.

Hope (l.c.) mentions Swarna nadi near Mussoorie as its locality. Not observed by the author.

(Gamble, Hope & Marten collected it from Dehra Dun and Mussoorie, sheets in DD; Hope from Swarna nadi, Mussoorie, 1,350-1,500 m, dated 1881 and Mackinnon from same place, dated 1903, sheets in CAL).

DRYNARIA (Bory) J. Smith

1. *D. MOLLIS* Bedd., Ferns Brit. India, t. 216, 1867, and Handb. Ferns Brit. India, 341, t. 130, 1883.

Syn.: *Polypodium rivale* Mett. ex Bak., Syn. Fil., 368, 1867; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 556, 1880.

Common around Nainital, 1,800-2,400 m altitude. Also collected from near Narkanda, 2,100 m and enroute Chadwick-falls, 1,800 m (Simla). Grows as an epiphyte and occasionally as a lithophyte in humus rich places. The dimorphic fronds are very characteris-

tic - smaller sterile fronds are stiff and perennial which are responsible for the accumulation of soil and humus to conserve water, while the larger fertile fronds are shed after the rainy season.

2. \*D. *PROPINQUA* (Wall. ex Mett.) J. Smith, Jour. Bot., 4, 61, 1841; Bedd., Handb. Ferns Brit. India, 339, t. 189, 1883; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 15, 175, 1964.

Bas.: *Polypodium propinquum* Wall. ex Mett., Pol. 120, n. 239, t. 3, f. 30, 1857; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 556, 1880; Hope, Jour. Bomb. nat. Hist. Soc., 15, 89, 1903.

According to Hope (l.c.) it is met with near Joshimath and en-route Kidar-kanta, 1,200-2,100 m (Garhwal) and Sarju valley (Almora).

(Duthie from Gori valley, 1,500-1,800 m, dated 20.8.1884, sheet no. 3689, Hope from valley below Nainital, 1,400-1,500 m, dated 22.9.1890, sheet no. 120 in DD; Strachey from Kumaon, 1,350 m, dated Aug. 1848, Mackinnon from Garhwal, 1,800 m, dated April 1881, Champion from Kumaon, 1,200 m, dated 20.3.1927 in CAL).

#### *MICROSORIUM* Link

1. *M. MEMBRANACEUM* (D. Don) Ching, Bull. Fan Mem. Inst. Biol., 4, 309, 1933; Sledge, Bull. Brit. Mus. (Nat. Hist.), 2, (5), 143, 1960.

Bas.: *Polypodium membranaceum* D. Don, Prod. Fl. Nepal., 2, 1825; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 560, 1880.

Syn.: *Pleopeltis membranacea* Bedd., Handb. Ferns Brit. India, 355, 1883.

Very common between 1,500-2,700 m, especially around Simla, 2,100 m; Mossy-falls, 1,500 m (Mussoorie); Mangoli, 1,500 m and near Bhowali, 2,000 m (Nainital) and Dhakuri forest, 2,700 m (Almora).

Grows as an epiphyte or lithopyhte particularly in damp places. Occasionally observed on humus rich soil under the shrubs.

2. *M. ZIPPELII* (Bl.) Ching, Bull. Fan Mem. Inst. Biol., 4, 308, 1933; Mehra & Bir, Res. Bull. Panjab Univ. (N.S.), 17, 175, 1964.

Bas.: *Polypodium zippelii* Blume, Fl. Jav. Fil., 172, t. 80, 1829; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 561, 1880.

Syn.: *Pleopeltis zippelii* Moore, Ind. Fil., 348, 1862; Bedd., Handb. Ferns Brit. India, 357, 1883.

*Polypodium heterocarpum* Blume, Fl. Jav. Fil., 167, t. 75, 1829; Hope, Jour. Bomb. nat. Hist. Soc., 15, 93, 1903.

Collected from Kumaon hills at Jageshwar, 1,500 m; rare. Hope (l.c.) reported it from Dalhousie, 1,500 m.

#### Family Grammitaceae

##### *CTENOPTERIS* Blume

1. \**C. SUBFALCATA* (Bl.) Kunze in Bot. Zeit., 6, 120, 1848; Sledge, Bull. Brit. Mus. (Nat. Hist.), 2 (5), 156, 1960.

Bas.: *Polypodium subfalcatum* Blume, Enum. Pl. Jav., ii, 130, 1828, and Fl. Jav. Fil., t. 87A, B, 1829; Clarke, Trans. Linn. Soc. Lond., II, Bot., 1, 549, 1880; Bedd., Handb. Ferns Brit. India, 314, t. 168, 1883.

Syn.: *Ctenopteris subminuta* (v. A. v. R.) Holtt., Fl. Malaya, II, 228, 1954 (?).

Met with in Garhwal and Kumaon hills, between 1,500-2,100 m.

(Duthie from Kumaon above Gini, 1,800-2,100 m and near Sora, sheet no. 3690 in DD; Mackinnon from Garhwal, 1,500 m, dated 1881, Duthie from Kumaon, 1,800-2,100 m, dated 17.8.1884 in CAL).



## COMMENTS

### DECIDUOUS NATURE OF FERNS

The ferns shed their fronds during winter in apline and temperate areas and in dry months in sub-tropical situations. The new foliage is developed from dormant rhizomes during the rainy season and the active life-cycle is completed in three to five months' period of high humidity and optimum temperature. Some lithophytic and roadside ferns produce young fronds before the onset of monsoons. These include *Athyrium pectinatum*, *A. puncticaule*, *Diplazium giganteum*, *Thelypteris levingei*, *Asplenium trichomanes*, *A. indicum* and *Polypodium amoenum*. The dormancy in such species is, probably, broken by a decrease in the summer temperature and availability of some moisture due to pre-monsoon showers. But luxuriant growth is accomplished with the proper monsoons.

During the course of present rambles about 40 species were noticed to bear fronds throughout the year. Many of these thrive at low altitudes, below 1,500 m in comparatively drier and warmer climate. The notable examples are: *Cheilanthes farinosa*, *Pteris stenophylla*, *P. vittata*, *Adiantum incisum*, *A. capillus-veneris*, *Polystichum obliquum*, *Diplazium spectabile*, *Thelypteris erubescens*, *Cyclosorus dentatus*, *Hypodematium creatum*, *Asplenium trichomanes*, *A. dalhousiae*, *Woodwardia radicans* and *Lepisorus nudus*. The temperate species like *Pteris cretica*, *P. quadriaurita*, *Polystichum squarrosus*, *P. aculeatum*, *Cyrtomium caryotaedium*, *Dryopteris marginata*, *D. odontoloma* and *Arthromeris wallichiana* withstand the winter snow as evidenced by the persistence of last year's fronds shortly after the melting of snow.

### FREQUENCY OF EPIPHYTES

The present exploration revealed that more than 30 species inhabit Kumaon hills, only two grow in small patches in Kashmir, and none is found in inner arid ranges such as Kalpa and Pangri

valleys. This westward decrease or paucity of epiphytic ferns is manifested not only in the number of species but in their luxuriance too. Earlier, Kashyap (1925) had noted progressive rarity of fern epiphytes from Kumaon westwards and reported the absence of epiphytic ferns and orchids in the inner drier Sulej valley. Bir (1963) pointed out that the epiphytes go on decreasing as we proceed towards west of Darjeeling.

The paucity of epiphytic ferns towards the west appears to be correlated to lower humidity and prevalence of conifers. Table - I shows that the amount of precipitation in the form of rains is highest at Nainital (2,597.2 mm) and lowest at Srinagar (664.0 mm). In the dry valleys of Kalpa and Pangi the precipitation is primarily in the form of snow, while the rain is a rare feature. Moreover, the duration of rainy period shortens westwards. The conifers, dominant in the Western limb of the Himalayas, do not support the epiphytic flora due to the resinous nature of the bark and absence of thick persistent spongy covering, except occasionally when thick layer of humus covers their trunks. Epiphytes are generally housed on broad-leaved trees which have greater representation towards the eastern part of the Himalayas.

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# NORTH WESTERN HIMALAYAS

(AREA SURVEYED)

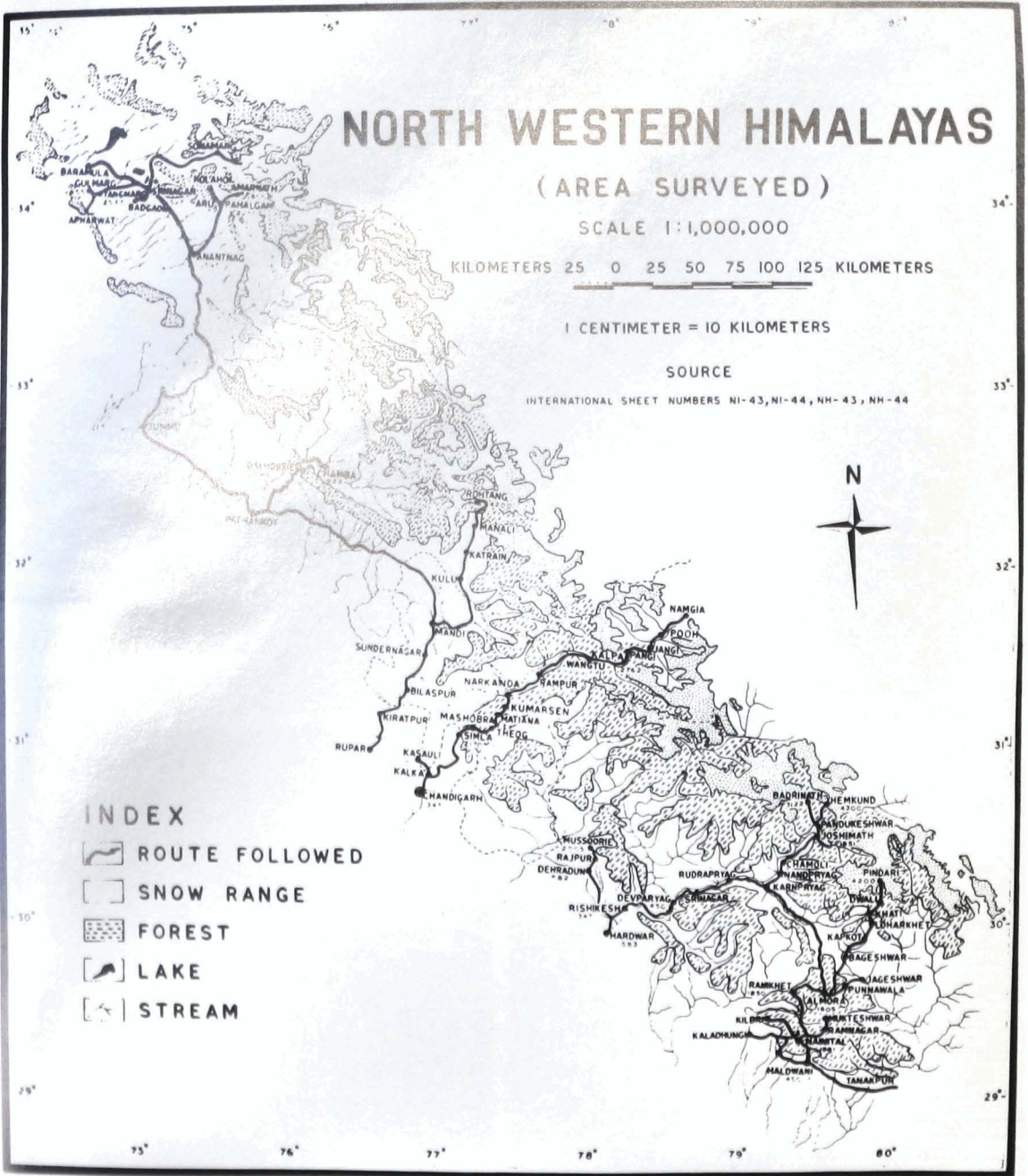
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## INDEX

-  ROUTE FOLLOWED
-  SNOW RANGE
-  FOREST
-  LAKE
-  STREAM

Fig. 2: A tree trunk heavily infested with *Polypodium microrrhizoma* along with a few individuals of *Araiostegia pseudocystopteris* near Nainital, 2,100 m.

Fig. 3: *Arthromeris wallichiana* growing on trees near Loharkhet, 2,100 m (Almora).

Fig. 4: *Lepisorus clathratus*, a common high altitude epiphyte growing on the trunk of *Quercus semecarpifolia* near Dalhousie, 2,400 m.

Fig. 5: *Lygodium flexuosum*, a climber on bushes in Bharbar forest, 300 m (Nainital).







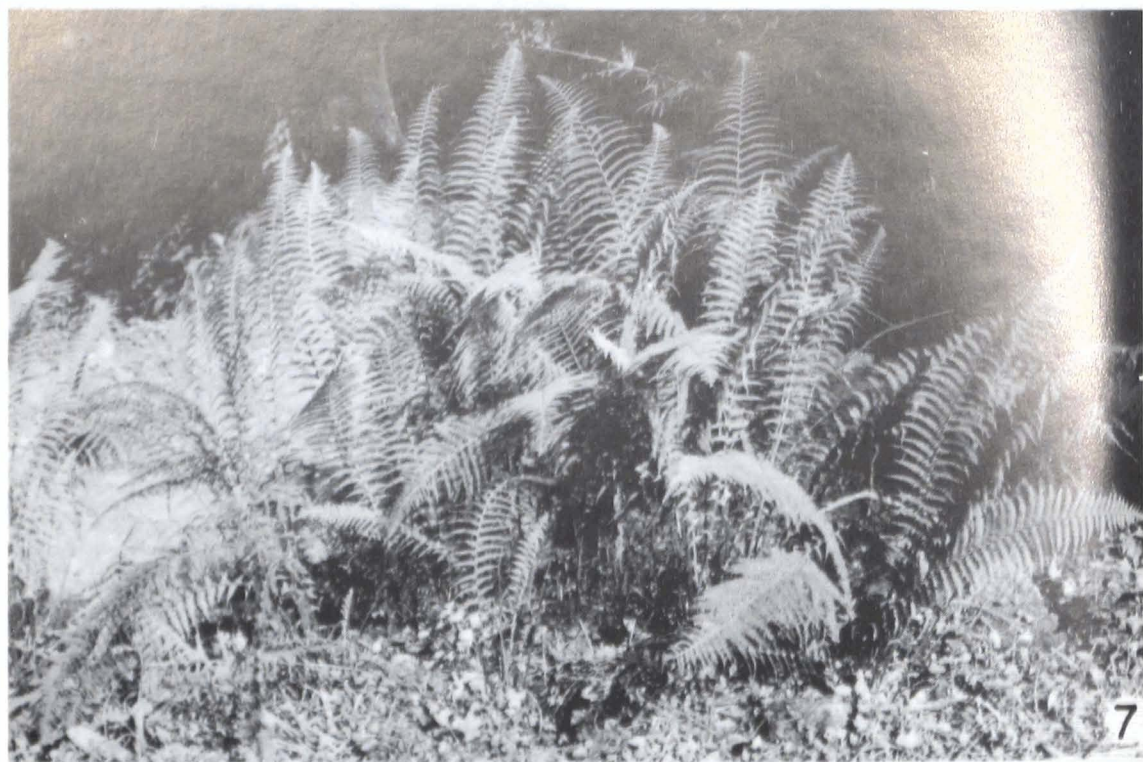


Fig. 6: A population of *Pteris wallichiana* covering vast areas under oak forest around Dhakuri, 2,100 m (Almora).

Fig. 7: *Dennstaedtia appendiculata* forming a big colony along roadside near Khati, 2,400 m (Almora).



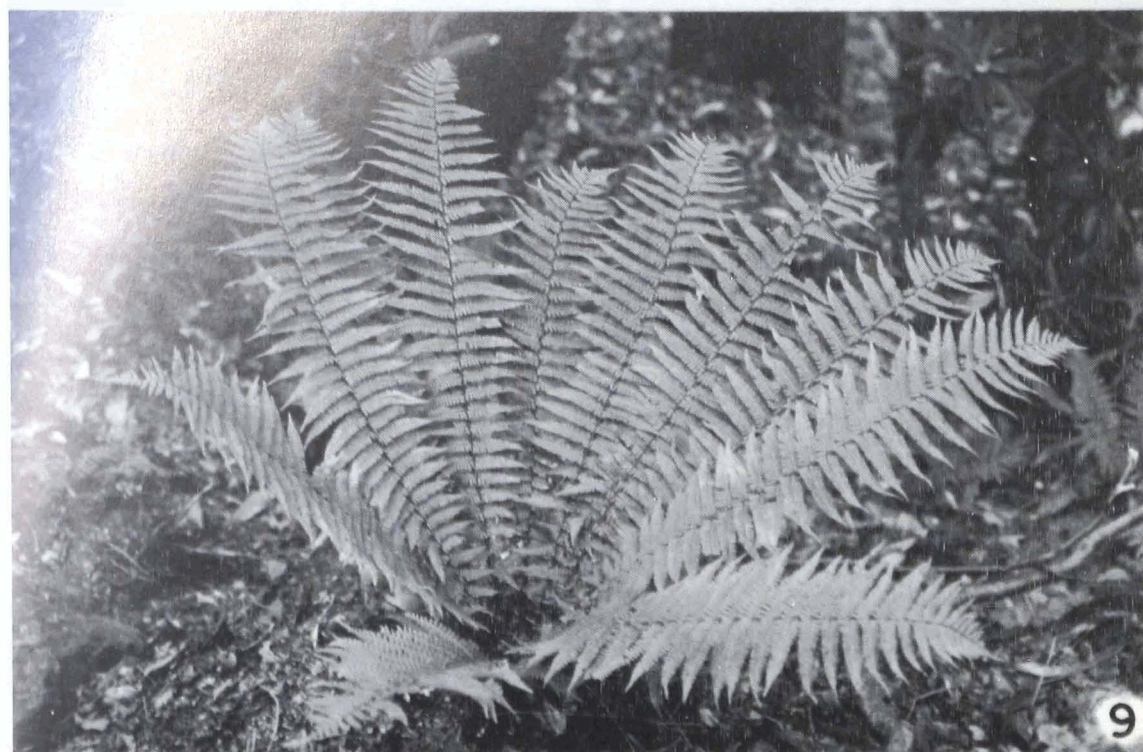


Fig. 8: A roadside patch formed by the dimorphic fronds of *Pteris cretica* enroute Bakrota, 2,400 m (Dalhousie).

Fig. 9: *Dryopteris wallichiana* forming a beautiful basket near Dwali, 2,700 m (Almora).





Fig. 10: A luxuriant patch of *Onychium contiguum* near Hotto, 2,700 m (Simla).

Fig. 11: *Thelypteris levingii* growing in-between big boulders in a ravine near Tangmarg, 2,200 m (Kashmir).





Fig. 12: *Woodsia elongata* occupying exposed dry rocks at high altitudes near Khati, 2,400 m (Almora).

Fig. 13: A conspicuous lithophyte, *Adiantum capillus-veneris* covering the moist shaded wall of Nishat Gardens, Srinagar, 1,500 m (Kashmir).





Fig. 14: *Adiantum incisum* inhabiting dry exposed rocky wall near Srinagar, 900 m (Garhwal).

Fig. 15: *Polypodium amoenum*, a common litophyte of higher elevations growing near Lariakanta, 2,400 m (Nainital).



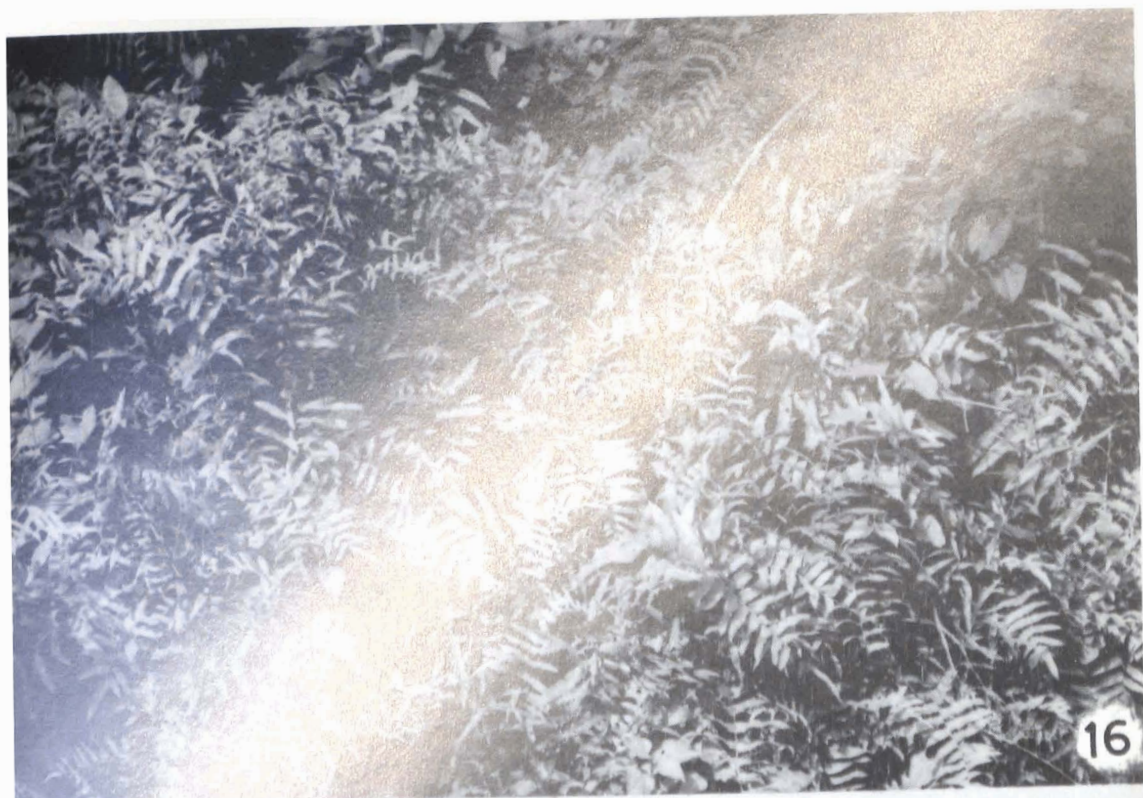


Fig. 16: A gregarious patch of *Ampelopteris proliferata* on a moist shaded wall in Bhabar forest, 300 m (Nainital).

Fig. 17: *Phymatodes stewartii* on a moist shaded boulder, near Loharkhet, 2,400 m (Almora).





Fig. 18: A colony of *Salvinia auriculata* in Khajjiar lake, 1,800 m (Dalhousie).

Fig. 19: A free floating dense mat of *Azolla pinnata* in a pond near Chandigarh, 300 m.



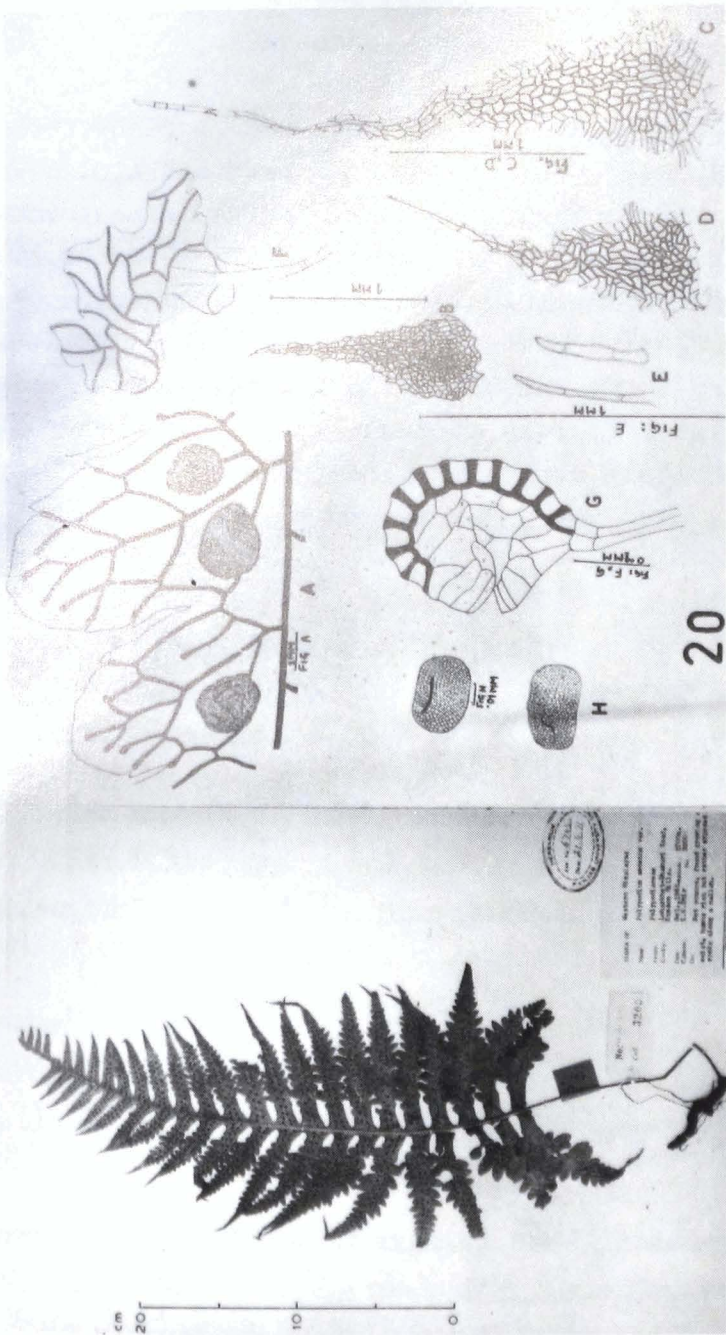


Fig. 20: *Polypodium amoenum* var. *pinnatifidum* — a. a plant (Holotype), A. a part of pinna showing venation and position of sori, B. rhizome scale, C. rachis scale, D. rachilet scale, E. hairs, F. paraphysis, G. sporangium, H. spores.

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