

## Taxonomic Studies On The Family Polypodiaceae (Pteridophyta) Of Nainital Uttarakhand

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**ABSTRACT:** The present account deals with the members of the family - Polypodiaceae (Pteridophyta) from Nainital. In the present work, 9 genera and 14 species have been collected and studied i.e. *Arthromeris*, *Colysis*, *Goniophlebium* and *Microsorium* (1 species each), *Drynaria* and *Phymatopteris* (2 species each), *Lepisorus*, *Polypodiodes* and *Pyrrosia* (3 species each). Some of the taxa of ferns reported earlier from Nainital by previous workers based on wrong identification have been placed under the heading excluded / doubtful species giving only botanical name and the reasons of their being excluded / doubtful species are based on Khullar (1994, 2000 & 2001). [New York Science Journal. 2009;2(5):47-83]. (ISSN: 1554-0200).

**Keywords:** Pteridophytes, polypodiaceae, Uttarakhand

### Introduction

The Uttarakhand state is situated between 77°45'-81°E longitude, 29°5'-31°25'N latitude. The state constitutes the central part of the Himalaya and is rich in pteridophytic vegetation, due to varied climatic conditions and topography.

Nainital is a well known summer hill resort of India and is situated on the outer hills of Kumaun Himalaya. It harbours a rich and varied flora very different from the vast

plains of India. The rich and varied flora of this place is a special attraction for a large number of tourists who visit this hill station for the sake of making plant collections. Although the flora of Nainital is very well known today, but the ferns and fern-allies have not received due attention. This may be probably due to the lack of interest or the difficulties involved in their identification. The study area encompassing a total area of 208.5 km<sup>2</sup>, lies within the latitudes of 29° 19' - 29° 28' North and longitudes of 79° 22' - 79° 38' East. It includes the main portion of the famous lake region lying along the south-central sections of district Nainital. Within the region, therefore lie the well known lakes of Nainital, Khurpatal, Sat tal, Bhimtal and Naukuchiatal. From the highest altitude around Nainital valley, the drainage radiates to almost all directions. The principal drainage outlet from the lake of Nainital ultimately forms a major river known as Ballia which traverse the region in the south-eastern direction and ultimately joins the Gola river near Ranibagh. It is here again that the drainage emerging from the Sat tal and Naukuchiatal area converges and ultimately joins the main river Gola. To the north of Nainital, the region is drained by the tributaries of the Kosi river which also marks the boundary of the region for some distance. Towards north-west, there are number of seasonal streams that take rise from the outermost ranges of the Siwalik and flow in a generally south-west to north-east direction before emerging into foothill zone of Bhabar.

Physiographically the Southernmost narrow belt called the Siwalik hills and with ranges averaging elevations of 1500-1600 m makes a geologically different area from the rest of this region lying northwards which falls within the Lesser Himalaya. The Siwalik comprising of tertiary and pleistocene deposits. The principal rock types of this group include such sedimentary rocks as fine-grained sandstone with interbedded shale bands and conglomerates. This zone constitutes the youngest part of the Himalayan system and the constituent rocks are friable and prone to erosion. Towards the north, the Lesser Himalaya, with elevation ranging from 1200-2611 m is a distinct geological unit generally with crystalline and metamorphic rocks such as granites, gneisses and schists. The lesser Himalaya are separated from the Siwaliks by a fault called Main Boundary Fault-which is tectonically active zone characterised by landslides and such other landscape changes.

The publication of very comprehensive account of plant collections from Kumaun and

adjacent parts of Garhwal by Sir Richard Strachey and J.E. Winterbottom between the years 1846-1849 followed the classical works. The original catalogue was published in 1852 in *Atkinson's Gazetteer of Himalayan Provinces and Oudh*. This original catalogue of Strachey and Winterbottom was later revised and supplemented by J.F. Duthie (1906), which is known as *Catalogue of the Plants of Kumaun and of the adjacent portions of Garhwal and Tibet based on the collections made by Strachey and Winterbottom during the years 1846-1849* and on the catalogue originally prepared by Sir Richard Strachey in 1852, by adding the results of previous and subsequent botanical explorations. This catalogue still functions as a milestone for the floristic works including pteridophytes. For the entire Kumaun Himalaya, Pangtey and Punetha (1987) attempted for the first time after Duthie (1906) to enumerate all the pteridophytes then known to them based on their collections coupled with previous records. It was followed by the compilation of a list of ferns of Kumaun by Pande (1990).

Herbarium specimens of plants drawn are deposited in the Herbarium, Department of Botany, D. S. B. Campus, Kumaun University, Nainital. The figures of the whole plant or frond or part of it are natural size, while for the detailed drawings the following magnifications have been used; dermal appendages (x 17.5), magnified portion (x 100), spores (x 450), part of lamina to show venation and arrangement of sori (x 150), indusia (x 17.5) following Khullar (1994).

Family : **POLYPODIACEAE** Berchtold & Presl

Prirozen. Rostl. **1**: 272 (1820); *emend.* Ching, *Sunyatsenia* **5**: 257 (1940).

Rhizome long or short-creeping, cylindrical or dorsiventrally compressed, much branched, dictyostelic, scaly; scales peltate, clathrate or non-clathrate. Fronds isomorphic or dimorphic. Stipes articulate to a short phyllopodium, in two dorsal rows on the rhizome. Lamina simple or pinnate, margin entire or variously lobed; veins free or reticulate, areolae with or without free often branched swollen included veinlets. Sori exindusiate, superficial, rounded, sometimes elongated or acrostichoid, distributed all over or partly lower surface of the lamina. Spores bilateral, monolete, perinate or non-perinate, smooth or verrucose or tuberculate or spinulose.

Type: *Polypodiurn* L., Sp. Pl. **2**: 1082 (1753); *emend.* Ching, *Contrib. Inst. Bot. Nat. Acad. Peiping* **2**: 31 (1933).

#### **KEY TO GENERA**

- A. Sori linear, elongated, oblique to the costa ..... **2. Colysis**
- A. Sori rounded or oval ..... **B**
- B. Fronds dimorphic ..... **3. Drynaria**
- B. Fronds isomorphic ..... **C**
- C. Lamina simple, margin entire ..... **D**
- C. Lamina margin deeply lobed or lamina pinnate ..... **F**
- D. Stellate hairs present on the lower surface of the lamina; sporangia acrostichoid, distributed over a larger portion of the lower surface of the lamina; soral paraphyses absent.....**9. Pvrrosia**
- D. Stellate hairs absent; sporangia aggregate into small Sori, which are present in either one or many rows on either side of the rachis and 2-3 between main lateral veins.....**E**
- E.** Sori in a single row on either side of the rachis: soral paraphyses irregular or ovatelaneolate or subrhomboidal, umbrella-shaped, peltately or non-peltately fixed.....**5. Lepisorus**
- E. Sori in many rows on either side of the rachis and 2-3 between main lateral

- Veins; soral paraphyses simple ..... 6. **Microsorum**
- F. Veins anastomosing to form many irregular areolae, included veinlets simple or forked.....G
- F. Veins anastomosing to form a single row of areolae on either side of the costa, costal areolae with one included veinlets. marginalveins free H
- G. Lamina simple, deeply pinnatifid (simple, trifid, palmatifid) or pinnate; margin deeply lobed to the rachis; areolae with or without free included veinlets with swollen tips: sori in a row on either side of main vein and one between the lateral veins or irregularly biseriate ..... 7. **Phymatopteris**
- G. Lamina pinnate; areolae with simple or forked included veinlets, running on all sides; sori in 1 or 1-2-seriate between each pair of main lateral veins ..... 1. **Arthromeris**
- H. Lamina pinnate at least in the major lower half Of lamina, the remaining upper pinnatifid ..... 4. **Goniophlebium**
- H. Lamina simple, deeply pinnatifid, margin deeply lobed to the rachis, sometimes the lower 1-2 pairs of lobes free .....8. **Polypodiodes**

### 1. ARTHROMERIS

*Arthromeris* (Moore) J. Smith, Hist. Fil.: 110 (1875).

*Polypodium* D. Don, Prodr. Fl. Nepal.: 3 (1825), *pro parte*.

*Phymatodes* Presl, Tent. Pterid. : 195 (1836), *pro parte*.

*Drynaria* J. Smith, Bot. Mag. 72 Comp. : 14 (1846), *pro parte*.

*Polypodium* sect. *Phymatodes* Hook., Sp. Fil. 5: 90 (1853).

*Pleopeltis* sect. *Arthromeris* Moore, Index Fil. : 77 (1857).

Rhizome long-creeping, thick, somewhat fleshy, densely scaly; scales brown, peltate, non-clathrate, laminae elongate, narrow, lanceolate, attenuate. Fronds isomorphic. Stipes rather distant, long, articulated to short podophylla. Lamina pinnate, imparipinnate, glabrous; pinnae opposite or alternate, usually sessile, prominently articulated to rachis, lanceolate, margin entire, cartilaginous or with a broad hyaline membrane, lower pinnae usually the largest; terminal pinnae similar to lateral ones; veins main lateral veins distinctveinlets anastomosing to form many irregular areolae, included veinlets simple or forked, running on all sides. Sori exindusiate, without paraphyses, 1 or 1-2-seriate, between each pair of main lateral veins, superficial. Spores bilateral, monolete, non-perinate, exine more or less spinulose.

Type: *Arthromeris Juglandifolia* (D. Don) J. Smith, Hist. Fil. : 111 (1875).

**Arthromeris wallichiana** (Spreng.) Ching, Contrib. Inst. Bot. Nat. Acad. Peiping 2: 92 (1933); Chandra, J. Bombay nat. Hist. Soc. 74: 649 (1979); Dhir, Biblioth. Pterid. 1: 129 (1980); Dhir & Sood, Biblioth. Pterid. 2: 94 (1981); Pangtey *et al.*, Him. Res. & Dev. 1: 157 (1982); Trivedi *et al.*, J. Indian Bot. Soc. 62: 94 (1983); Dixit, Census Indian Pterid.: 35 (1984); Singh *et al.*, Indian J. For. 9: 6 (1986); Pangtey & Punetha in Western Him. 1: 410 (1987); Pande & Dashila, Indian Fern J. 5: 87 (1988); Geobios new Reports 8: 108 (1989); Indian Fern J. 7: 145 (1990); Pande & Basera, Indian Fern J. 5: 158 (1998); Pande, Khullar *et al.*, Ferns Nainital: 158 (1990); Khullar, Him. Res. & Dev. 7: 60 (1988); Ill. Fern Fl. West Him. 1: 70. t. 26 (1994); Chandra, Ferns India: 410 (2000).

*Polypodium wallichianum* Spreng., Syst. Veg. ed. 16, 4(1): 53 (1827); Mehra, Ferns Muss.: 26 (1939); Stewart, 150th Ann. Vol. Royal Bot. Gard. Calcutta 2: 169 (1942).

*Polypodium juglandifolium* D.Don, Prodr. Fl. Nepal.: 3 (1825); Hook., Syn. Fil.: 368 (1867); Clarke, Trans. Linn. Soc. Lond. II (Bot.) 1: 566 (1880); Hope, J. Bombay nat. Hist. Soc. 15: 96 (1903); Duthie, Cat. Pl. Kumaun: 230 (1906).

*Pleopeltis juglandifolia* Moore, Index Fil: 78 (1857); Bedd, Handb. Ferns Brit. India: 368 (1883); Handb. Ferns Brit. India Suppl: 98 (1892); Marten, J. Bombay nat. Hist. Soc. 19: 182 (1909).

Rhizome long-creeping, very thick, somewhat fleshy, densely scaly; scales brown, cuspidate-subulate, base broad, margin distantly toothed, apex acuminate, stramineous to pale brown, glaucous, glabrous, narrowly lanceolate, fimbriate-hairy. Stipes up to 30 cm long, stramineous to pale brown, thick, glabrous. Lamina pinnate, up to 40 x 30 cm, ovatelanceolate, texture coriaceous, glossy, glabrous; pinnae c 8 pairs, 15 x 4 cm, opposite but lower ones alternate, sessile, lanceolate, base cuneate or rounded, lower surface pale green or bluish-green, margin with a thick cartilaginous line, generally strongly repando-undulate, basal pinnae the largest, other pinnae gradually decrescent towards the terminal one; terminal pinna similar to the lateral ones; lateral veins prominent, reaching the margin, almost pallel, smaller veins anastomosing to form many irregular areoles; areoles with simple or forked free veinlets. Sori large, round, a single sorus between the main lateral veinlets, in a row on either side of the costa. Spores dark-brown, 28.0-35.0 x 45.5-52.5  $\mu\text{m}$ , non-perinate, exine densely tuberculate and granulose.

HABITAT: Grows on humid rocks in shade and also as an epiphyte.

DISTRIBUTION: Scattered from 1500-2700 m altitude.

UTTARAKHAND: NAINITAL: below Dhobighat.

INDIA: Himachal Pradesh; Sikkim; Darjeeling; Meghalaya; Nagaland; Manipur; Tripura.

GENERAL DISTRIBUTION: Nepal; Bhutan; Tibet; China; Thailand; Vietnam; Myanmar.

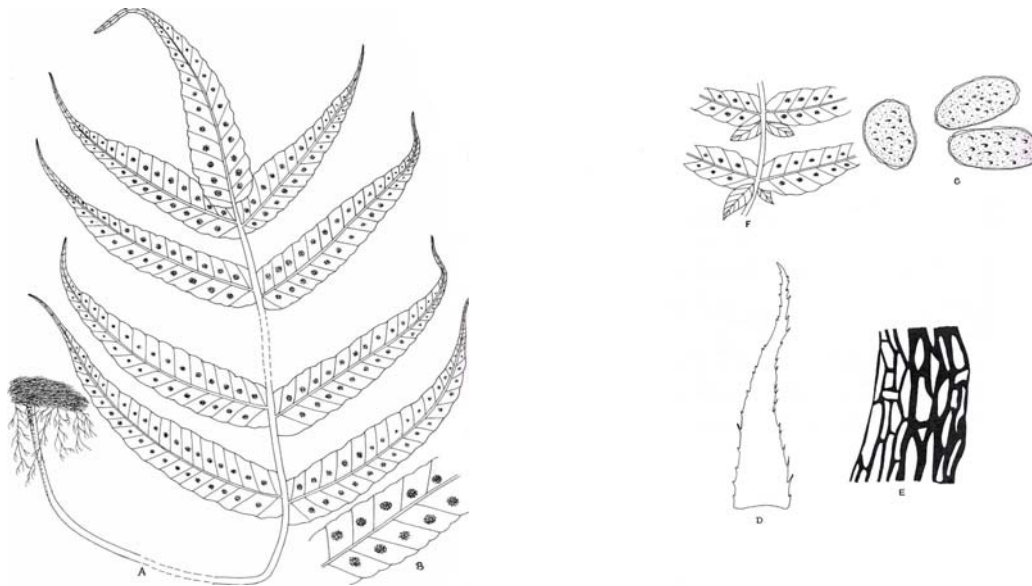


PLATE 1 A

PLATE 1 B

PLATE 1 A: *Arthromcris wallichiana* (Spreng.) Ching: A = Plant: B = Magnified part of lamina

PLATE 1 B: *Arthomeris wallichiana* (Spreng.) Ching: C= Spores; D= Rhizome scale; E= Magnified part of rhizome scale; F= Part of lamina.

## 2. COLYSIS

*Colysis* C. Presl, Epim. Bot.: 146 (1851); Fee, Gen. Fil.: 172 (1850-1852), *non* J. Smith (1875).

*Grammitis* Hook. & Grev., Icon. Fil.: t. 6 (1827), *non* Sw.(1801).

*Grammitis sect. Diagramma* Blume, Enum. Pl. Java: 118 (1828).

*Selliguea* Bory, Dict. Class. d'hist. Nat. **6**: 587 (1824); Presl, Tent. Pterid. : 216 (1836); Bedd., Handb. Ferns Brit. India :389 (1883), *pro parte*.

*Gymnogramme sect. Selliguea* Hook., Sp. Fil. **5**: 161 (1964); Hook. & Baker, Syn. Fil.: 387 (1868), *pro parte*.

*Polypodium* Mett., Polyp. : 214 (1857).

*Polypodium sect. Pleopeltis* Diels in Engler & Prantl, Nat. Pflanzenfam. *Pleopeltis* : 316 (1899), *pro parte*.

Rhizome long-creeping, thin, subhypogeous, scaly; scales ovate-acuminate, thin, clathrate, laminae clear, large. Stipes far apart, articulated to the Rhizome. Lamina simple with margin entire or deeply pinnatifid or even palmately lobed or pinnate, texture thin, herbaceous; pinnae adnate to the rachis; veins rather poorly developed; veinlets anastomosing irregularly in two rows of areolae, free included veinlets clavate. Sori linear, elongate, continuous or sometimes interrupted, one between each pair of main lateral veins, oblique to the costa, rarely subcostal, exindusiate. Spores light-brown to yellowish, bilateral, monolete, non-perinate, exine smooth.

Type: *Colysis hemionitides* Presl, Epim. Bot.: 147 (1849).

*Colysis elliptica* (Thunb.) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 333 (1933); Dixit, Census Indian Pterid.: 36 (1984); Chandra, Ferns India: 397 (2000).

*Polypodium ellipticum* Thunb., Fl. Jap. : 335 (1784); Chowdhery, Pterid. Fl. Upper Gangetic Plain: 70 (1973).

*Colysis elliptica* (Thunb.) Ching var. *pothifolia* (Ham. ex D. Don) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 334 (1933); Dhir, Biblioth. Pterid. **1** : 130 (1980); Bir *et al.*, Pterid. Fl. Garhwal Him.: 23 (1983); Dixit, Census Indian Pterid.: 36 (1984).

*Hemionitis pothifolia* Ham. ex D. Don, Prodr. Fl. Nepal.: 13 (1825).

*Selliguea pothifolia* J. Smith, J. Bot. **3**: 399 (1841).

*Gymnogramma elliptica* Hook. & Baker, Syn. Fil.: 389 (1868); Clarke, Trans. Linn. Soc. Lond. II (Bot.) **1**: 570 (1880); Hope, J. Bombay nat. Hist. Soc. **15**: 102 (1903).

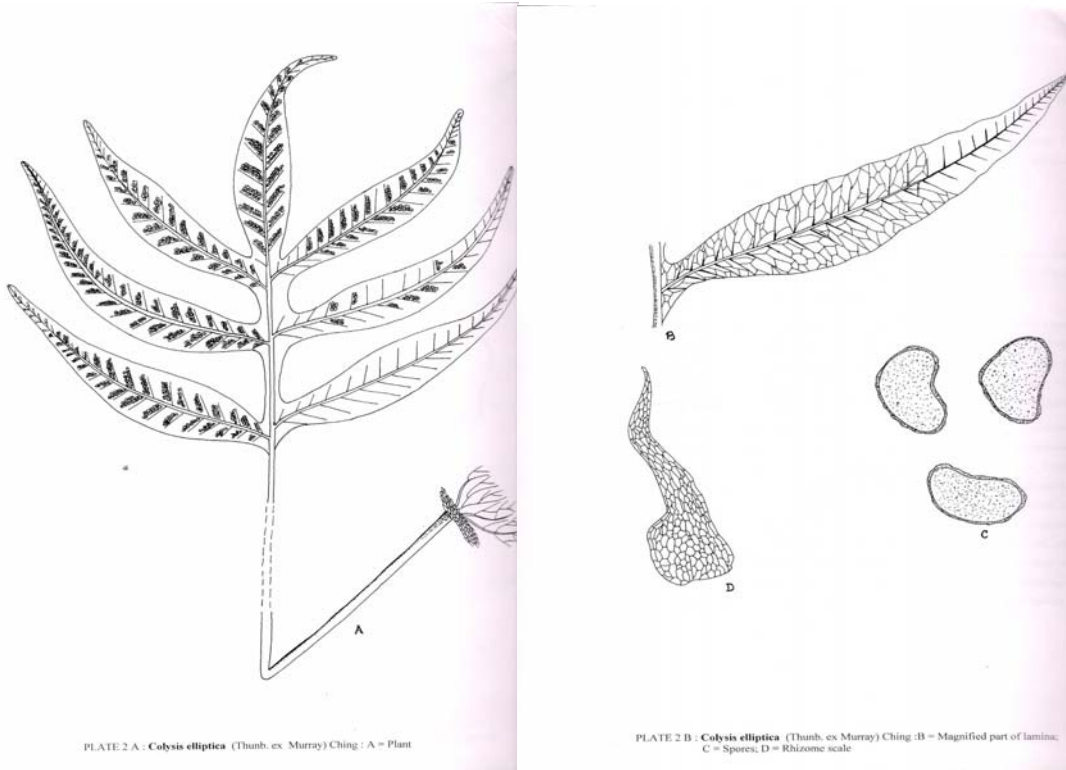
*Selliguea elliptica* (Thunb.) Bedd., Ferns Brit. India: Index (1870).

*Colysis pothifolia* (Ham. ex D. Don) H. Ito, J. Jap. Bot. **11**: 89 (1935); Dixit, Census Indian Pterid.: 37 (1984); Pangtey *et al.*, J. Bombay nat. Hist. Sc. **83**: 683 (1986); Pangtey & Punetha in Western Him. **1**: 409 (1987); Pande; Indian Fern J. **7**: 145 (1990); Khullar *et al.*, Ferns Nainital: 159 (1991); Khullar, Him. Res. & Dev. **7**: 60 (1988); Ill. Fern Fl. West Him. **1**: 73. t. 27 (1994); Chandra, Ferns India: 399 (2000).

Rhizome long-creeping, thick, woody, scaly; scales dark-brown, concolorous, lanceolate, margin entire, apex acuminate. Stipes 30-60 cm long or longer, stramineous, thick, glabrous; rachis stramineous, broadly winged or quite wingless, glabrous. Lamina simple, 30 - 45 x 15 - 30 cm; texture subcoriaceous, glabrous, margin deeply lobed into 4-10 pairs of lobes or occasionally subpalmately divided into 3-5 lobes or even simple; lobes 14.0 x 2.0-2.5 cm, alternate, linear-oblong, dries green, base broadly decurrent, apex acuminate, terminal lobe almost as long as lateral ones; main veins of the lobes stout, prominent, other lateral veins anastomosing to form areolae, areolae unequal, free, included; veinlets with clavate ends. Sori exindusiate, linear, oblique, extending from the costae but not reaching the margin, punctiform, paraphyses light-brown, small, 1-2 celled. Spores light-brown or yellowish, 31.5 - 38.5 x 35.0 - 45.5  $\mu\text{m}$ , non-



perinate, exine smooth.



**HABITAT:** Grows in dark humid places.

**DISTRIBUTION:** Rare from 700-1200 m altitude.

**UTTARAKHAND:** NAINITAL: behind Jeolikote along the streams in oak-pine mixed forest, below Patuwadangar.

**INDIA:** Sikkim; Darjeeling; Meghalaya; Nagaland.

**GENERAL DISTRIBUTION:** Nepal; Bhutan; China; Taiwan; SW Japan; Vietnam; Korea; Philippines; Malaysia; Myanmar; Queensland.

## 2. DRYNARIA

*Drynaria* (Bory) J. Smith in Hooker J. Bot. **4**: 60 (1841) *nom. cons.*

*Polypodium* subgenus *Drynaria* Clarke, Trans. Linn. Soc. Lond. II (Bot.) **1**: 555 (1825); Hope, J. Bombay nat. Hist. Soc. **15**: 89 (1903)

Rhizome long-creeping, thick, densely scaly; scales brown, usually concolorous, occasionally with a central dark streak, lanceolate, peltate, non-clathrate, margin variously fimbriate, filamentous projections short or long, apex long acuminate. Fronds dimorphic. Sterile fronds usually much shorter than the fertile ones, persistent, dry; rachis prominent, brown, hairy or scaly or glabrous. Lamina simple, pinnatifid, ovate or lanceolate, deeply lobed, usually much shorter than the fertile ones, persistent, dry, hairy or glabrous; veins main lateral veins prominent, protruding on the lower surface, a well formed almost continuous row of areolae with or without free included veinlets. Fertile fronds: stipes prominent, usually winged due to the decurrent lamina bases, upper surface of rachis grooved, hairy; lamina simple, pinnatifid, but margin deeply

lobed almost to the rachis, lobes usually decurrent on stipe; veins profusely anastomosing as in sterile fronds, but costal areolae not as prominent as in the sterile ones. Sori exindusiate, small, round, close to costa, usually on the costal areolae, in a row on either side of the costa and one between each main lateral vein; paraphyses absent or 2-celled. Spores bilateral, monoletic, light-brown, nonperinate, exine variously ornamented.

Type: *Drynaria quercifolia* (L.) J. Smith, J. Bot. **3**: 392 (1841).

#### KEY TO SPECIES

- A. Margin of Rhizome scale fimbriate with long filamentous projections; lower lobes in the fertile fronds not reduced but of the same size as those in the middle of the lamina; veins forming 4-5 series of primary large areolae with smaller included areolae ..... 2. **D. propinqua**
- A. Margin of Rhizome scales with short teeth like projections; lower lobes much reduced, almost half the length of the middle lobes; veins forming 3-4 series of uniform areolae ..... 1. **D. mollis**

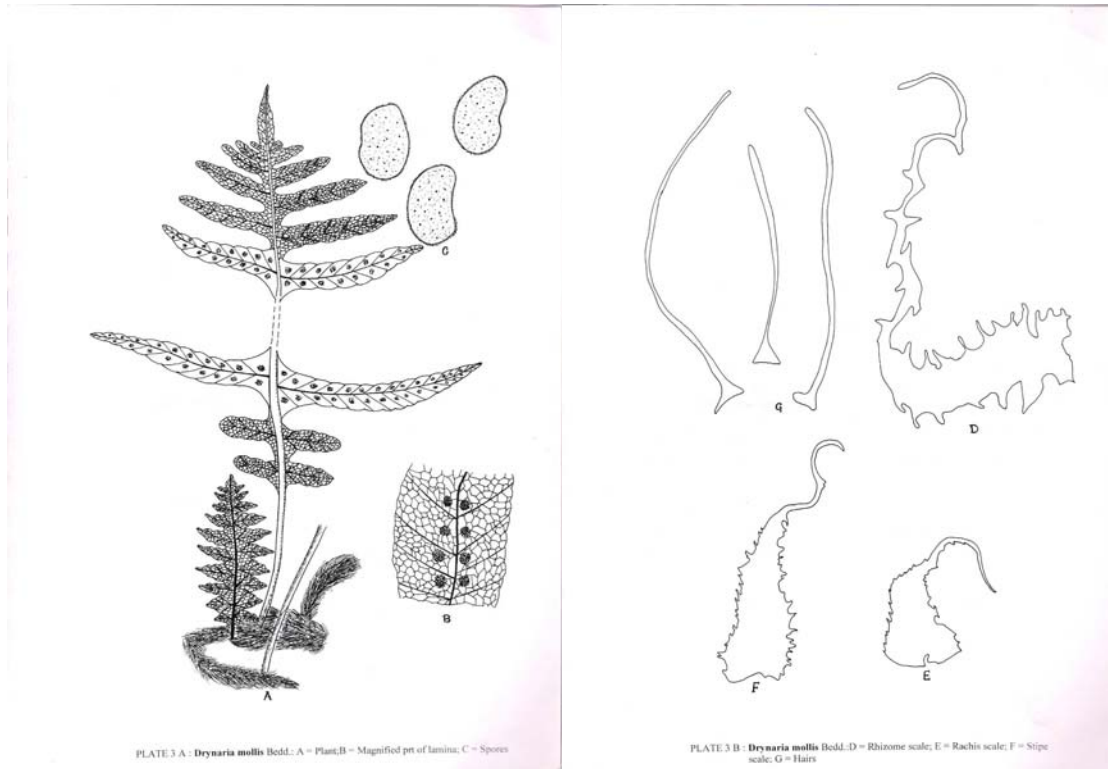
1. **Drynaria mollis** Bedd., Ferns Brit. India: t. 216 (1867); Handb. Ferns Brit. India: 341. t. 190 (1883); Marten, J. Bombay nat. Hist. Soc. **19**: 182 (1909); Mehra, Ferns Muss.: 26 (1939); Verma & Khullar, Fern. Gaz. **12**: 87 (1980); Dhir, Biblioth. Pterid. **1**: 130 (1980); Pangtey *et al.*, Him. Res. & Dev. **1**: 158 (1982); Bir *et al.*, Pterid. Fl. Garhwal Him.: 23 (1983); Dixit, Census Indian Pterid.: 58 (1984); Satija & Bir. Aspects Pl. Sci. **8**: 87 (1985); Pande & Kandpal, Acta Botanica Indica **14** (Suppl.): 121 (1986); Singh *et al.*, Indian J. For. **9**: 9 (1986);

*Drynaria rivale* (Mett. ex Hook.) Christ, Bull. Boiss. **7**: 6 (1899).

*Polypodium rivale* Mett. ex Hook. & Baker, Syn. Fil.: 368 (1867); Clarke, Trans. Linn. Soc. Lond. II (Bot.) **1**: 556 (1880); Hope, J. Bombay nat. Hist. Soc. **15**: 90 (1903); Duthie, Cat. Pl. Kumaun: 230 (1906).

*Drynaria tibetica* Ching & S.K. Wu in C.Y. Wu Fl. Xizangica **1**: 342 (1983); Khullar *et al.*, Ferns Nainital: (1991); Khullar, Ill. Fern Fl. West Him. **1**: 81. t. 29 (1994)

Rhizome long-creeping, thick, densely scaly; scales light to mid-brown, rarely darker, apex long acuminate. Fronds dimorphic, approximate. Sterile fronds: stipes short or none at all, winged, base scaly; scales brown, lanceolate, margin fimbriate, apex long acuminate; rachis brown, hairy, hairs hyaline, 3-4 celled, scaly, scales as on stipe. Lamina simple, pinnatifid, 10-15 x 6-8 cm, elliptical ovate, deeply lobed, lobes 1.5-3.5 x 0.8-1.0 cm, lanceolate, herbaceous, brown, glossy, margin entire, apex acute, margin entire, hairy, texture herbaceous, brown, glossy; veins prominent. Fertile fronds : stipes 3-7 cm long, light-brown, sparsely scaly, base densely scaly, scales as on sterile fronds, winged almost to the base; rachis light-brown, hairy. Lamina simple, deeply pinnatifid, 25-30 x 12 cm, ovate, margin deeply lobed almost to the rachis; lobes 2.0-5.5 x 1.0 cm, margin entire, hairy, apex acute; texture herbaceous, lower lobes generally much reduced in size, lowermost lobe decurrent on stipe; veins anastomosing to form 3-4 pairs of reticulate uniform sizes areolae between margin and costa, with or without free, simple included veinlets. Sori small, round, nearer to costa, usually on the first areolae towards the costa, in one row and one between the lateral veins; paraphyses short, about 2-celled. Spores brown, 24.5-35.0 x 31.5-56.0  $\mu\text{m}$ , exine spinulose.



**HABITAT:** Generally grows as an epiphyte on oaks and rhododendrons *etc.*

**DISTRIBUTION:** Restricted between 2000 and 3000 m altitude and quite common to abundant.

**UTTARAKHAND:** NAINITAL: Nainital, Cheena peak, Kilbury, Pangtey's Gorge, Mukteshwar, towards Land's end, Dorothy seat, Lariakanta.

**INDIA:** Himachal Pradesh; Sikkim; Darjeeling hills.

**GENERAL DISTRIBUTION:** Tibet; Nepal; Bhutan.

2. ***Drynaria propinqua*** (Wall. ex Mett.) J. Smith, J. Bot. **4**: 61 (1841); Pangtey *et al.*, Him. Res. & Dev. **1**: 158 (1982); Trivedi *et al.*, J. Indian Bot. Soc. **62**: 95 (1983); Dixit, Census Indian Pterid.: 58 (1984); Singh *et al.*, Indian J. For. **9**: 9 (1986); Khullar *et al.*, in Western Him. **1**: 355 (1987); Pangtey & Punetha in Western Him. **1**: 409 (1987); Punetha & Kaur, J. Econ. Tax. Bot. **9**: 285 (1987); Pande & Basera, Indian Fern J. **5**: 158 (1988); Pande, Geobios new Reports **8**: 108 (1989); Indian Fern J. **7**: 146 (1990); Khullar *et al.*, Ferns Nainital: 161 (1991);

*Polypodium propinquum* Wall. ex Mett., Abh. Senckenb. Natur. Ges. **2**: 120. t. 3. f. 50 (1857); Clarke, Trans. Linn. Soc. Lond. II (Bot.) **1**: 556 (1880); Hope, J. Bombay nat. Hist. Soc. **15**: 89 (1903); Duthie, Cat. Pl. Kumaun: 230 (1906).

*Drynaria prolifera* P. & H. Pande, Indian Fern J. **11**: 97 (1994), *nom. nud.*

Rhizome long-creeping, thick, scaly; scales russet to mid-brown, linear-lanceolate, margin fimbriate, filamentous projections very long, apex acuminate. Frond dimorphic, 3-5 cm distant on Rhizome. Sterile fronds: stipes very short or none, winged, brown, thick, scaly; scales deciduous, linear-lanceolate, fimbriate, filamentous projections long; rachis brown, scaly; scales as on the stipe but smaller. Fertile fronds: lamina simple, pinnatifid, 25-60 x 16-30 cm, ovate-oblong, margin entire, apex acute, upper segments ascending, lower deflexed, herbaceous, brown, hairy; veins prominent; costae and costules scaly; scales small. Fertile fronds: stipes 7-25 cm long, thick, sparsely scaly, base densely scaly, winged due to the decurrent lowermost lamina



lobes; rachis brown, grooved, scaly. Lamina simple, pinnatifid, 25-60 x 16-30 cm, ovate-oblong, deeply lobed to the rachis; lobes 7.0-16.0 x 1.0-1.5 cm, lanceolate, margin entire, not reduced; texture subcoriaceous, usually hairy, hairs short or 3-5-celled long; veins profusely anastomosing to form 3-5 primary large areolae with smaller included areolae which may contain free, simple or branched included veinlets; costae and costules scaly. Sori small, round on the costal areolae, one between each main lateral vein; paraphyses small, 2-celled. Spores yellowish-brown, 24-35 x 49-59  $\mu\text{m}$ , exine spinulose.



PLATE 4 A: *Drynaria propinqua* (Wall. ex Mett.) J. Smith: A = Plant; C = Spores

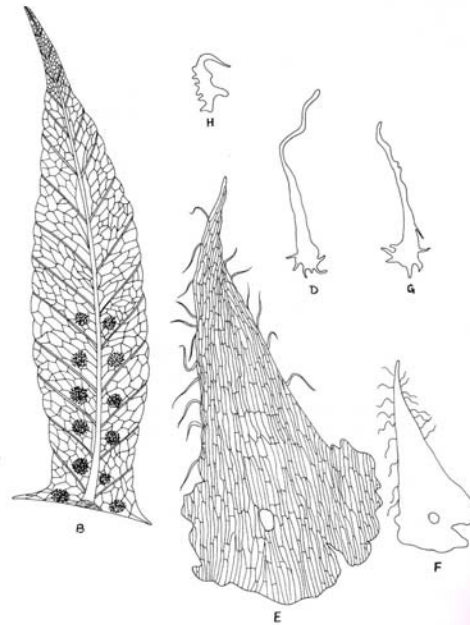


PLATE 4 B: *Drynaria propinqua* (Wall. ex Mett.) J. Smith: B = Magnified part of lamina; D = Rhizome scale; E = Magnified part of rhizome scale; F = Rachis scale; G = Costae scale; H = Costule scale

**HABITAT:** Grows as an epiphyte as well as a lithophyte.

**DISTRIBUTION:** Fairly common in Kumaun but becomes rarer further west between 1300 and 3000 m altitude.

**UTTARAKHAND:** NAINITAL: Bajoon, Patuwadhangar.

**INDIA:** Sikkim; Darjeeling; Assam; Meghalaya; Nagaland; Manipur; Tripura.

**GENERAL DISTRIBUTION:** Nepal; Bhutan; Tibet; S & C China; Vietnam; Thailand; Malaysia; Myanmar.

#### 4. GONIOPHLEBIUM

*Goniophlebium* (Blume) Presl, Tent. Pterid.: 185. t. 7 (1836).

*Polypodiatum* Ching, Acta Phytotax. Sin. 16: 29 (1978).

Rhizome long-creeping, dictyostelic, often glossy, scaly; scales dark-brown, small, deciduous at maturity, clathrate, base ovate, apex acuminate. Fronds isomorphic. Stipes distinct on Rhizome. Lamina pinnate or at least a major lower half of lamina pinnate, the remaining upper pinnatifid; pinnae sessile, articulated to the rachis, lower ones free and very shortly petiolate, middle ones with often  $\pm$  adnate base, distal ones confluent; veins anastomosing to form a single row of areolae on either side of the costa but marginal veins free; areolae with a free included veinlet. Sori superficial, not immersed; paraphyses triangular, pedicelate, clathrate, long stalked,

fugaceous. Spores light-brown or yellowish, bilateral, monolete, perinate.

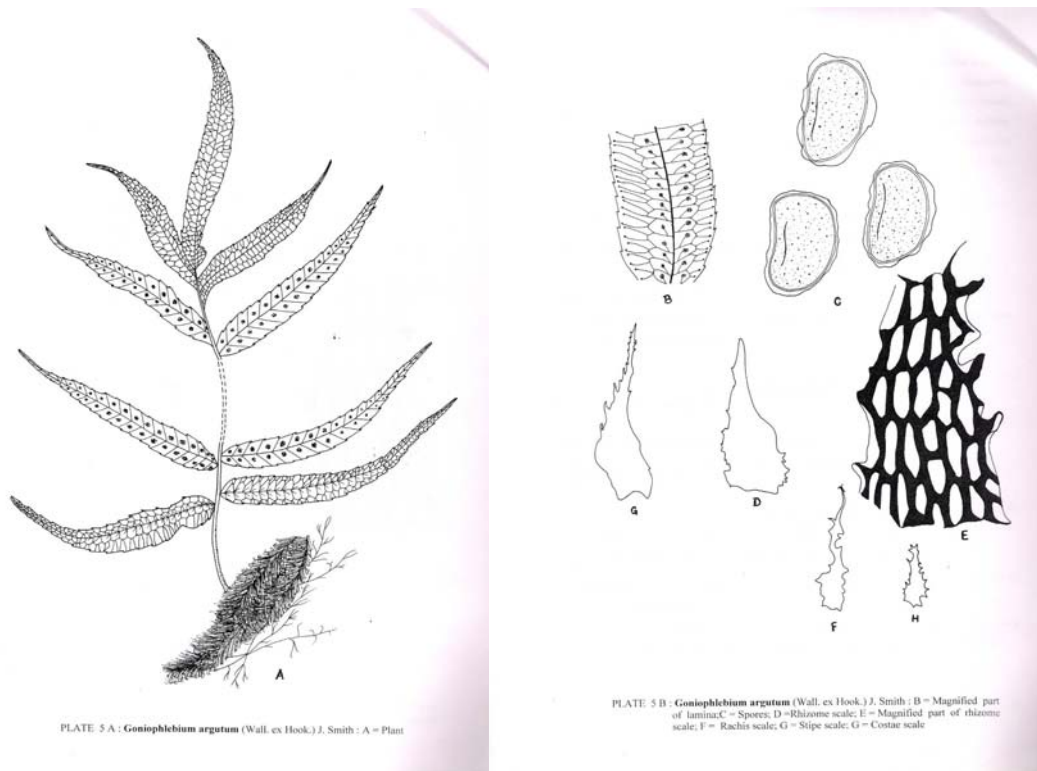
Type: *Goniophlebium argutum* (Wall. ex Hook.) J. Smith in Hooker Gen. Fil. ad t.51 (1840).

***Goniophlebium argutum*** (Wall. ex Hook.) J. Smith in Hook. Gen. Fil.: ad t. 51 (1840); Bedd., Ferns South. India: t. 69 (1863); Handb. Ferns Brit. India: 323 (1883); Bir *et al.*, New Botanist 1: 152 (1974); Chandra, Ferns India: 390 (2000).

*Polypodium argutum* Wall. ex Hook., Sp. Fil. 5: 32 (1863); Dhir, Biblioth. Pterid. 1: 121 (1980); Dhir & Sood, Biblioth. Pterid. 2: 91 (1981); Goel & Bhattacharyya, Indian J. For. 4: 36 (1981); Pangtey *et al.*, Him. Res. & Dev. 1: 159 (1982).

*Polypodiastrum argutum* (Wall. ex Hook.) Ching, Acta Phytotax. Sin. 16(4): 28 (1978); Dixit, Census Indian Pterid.: 51 (1984); Pangtey & Punetha in Western Him. 1: 408 (1987); Pande & Basera, Indian Fern J. 5: 159 (1988); Pande, Geobios new Reports 8: 109 (1989); Khullar *et al.*, Ferns Nainital: 179 (1991);

Rhizome long-creeping, thick, scaly; scales dark-brown to blackish, spreading, ovate-lanceolate or linear-lanceolate, margin fimbriate with short projections, apex hair pointed. Stipes 1.0-2.5 cm distant on rhizome, articulated on phyllopodia, c 10 cm long, light-brown, thick, glossy, sparsely hairy, hairy, hairs light-brown, few, multicellular, scaly; scales dark brown, short, fimbriate with long projections. Lamina pinnate or major lower half pinnate and the distal c 1/4 deeply pinnatifid, 30-50 x 15-25 cm; texture herbaceous, glabrous; pinnae many, 10.0-15.0 x 1.5-2.0 cm, lower ones opposite, upper alternate, sessile, patent, more or less adnate and decurrent, lanceolate, base broad, auricled or nearly round, apex acute, basiscopic side prominently auricled on both sides, margin serrate, terminal pinna similar to lateral ones but longer than the preceding 2-3 pairs below: main lateral veins prominent running mid-way to margin, anastomosing to form a series of large costal areolae, with simple included veinlets, marginal veins all free or rarely united, vein ends thickened, not reaching the margin, glabrous; costae very sparsely scaly, scales dark-brown, small caducous. Sori superficial, round, at the ends of free included veinlets in the costal areolae, in a single row on either side of costa and one between each main lateral vein, pamphyses peltate, clathrate, margin stellate, also simple,



2-6-celled ones. Spores yellowish, 28-38 µm.

HABITAT: This fern grows in the forests as an epiphyte / lithophyte.

DISTRIBUTION: Occasional between 1800 and 2700 m altitude.

UTTARAKHAND: NAINITAL: way to Kilbury, Lariakanta, Dhobighat.

INDIA: Himachal Pradesh; Darjeeling; Meghalaya; Nagaland.

GENERAL DISTRIBUTION: Nepal; Bhutan; Tibet; China; Taiwan; Vietnam; Laos; Thailand; Philippines; Myanmar.

## 5. LEPISORUS

*Lepisorus* (J. Smith) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 56 (1933).

*Drynaria* sect. *Lepisorus* J. Smith, Bot. Mag. 2. Compend. 13 (1824); Fee, Gen. Fil.: 272 (1852).

*Pleopeltis* Hook., Exot. Fl. **1**: t. 63 (1823); Gen. Fil. : t.18 (1838); Sp. Fil. **5**: 57 (1864); Bedd., Ferns South. India : 57(1873); Handb. Ferns Brit. India : 344 (1883). *pro parte*.

*Phymatodes* C. Presl, Tent. Pterid. : 196 (1836), *excl. type. nom. nud.*

*Polypodium* sect. *Pleopeltis* (Hook.) Christ, Farnkr. d. Erde : 102 (1897); C. Chr., Index Fil.: 506 (1906), *pro parte*.

*Polypodium* sect. *Phymatodes* (C. Presl) Hook., Syn. Fil.: 353 (1865); Clarke, Trans. Linn. Soc. Lond. II (Bot.) **1**: 557 (1880); Hope, J. Bombay nat. Hist. Soc. **15**: 90 (1903).

Rhizome long or sometimes short-creeping, thick or thin, branched, scaly; scales concolorous or bicolorous with the central cells generally dark - coloured with thick walls and marginal cells light-coloured, luminae opaque or clear, generally small, peltate, attached towards the base, ovate-acuminate or ovate-lanceolate or linear-subulate, base broad, margin entire or eroded or fimbriate (with long filamentous projections), apex acute or long acuminate, clathrate. Fronds generally in 2-rows on rhizome. Stipes articulated to the rhizome, approximate or distantly placed, generally short, often winged due to the decurrent lamina base, glabrous or scaly; scales generally deciduous; rachis often prominent on lower side, glabrous or scaly. Lamina simple, lanceolate or linear-lanceolate, base cuneate and often decurrent on stipe, apex acute, long acuminate or abruptly attenuated, margin entire, revolute in a few; texture thick or thin, coriaceous to subcoriaceous or herbaceous, glabrous or scaly; scales lanceolate; veins prominent or obscure forming series of areolae with or without free single or forked included veinlets. Sori exindusiate, when young densely covered with imbricate fuscous easily deciduous scales, round, oblong or elongate, medial or submedial in a single row on either side of the rachis, situated on the plexes of radiate veinlets; paraphyses isomorphic or dimorphic: (i) umbrella - shaped, peltate, clathrate, (ii) hair-like, 2-celled. Spores hyaline to yellowish, bilateral monoletate, non-perinate, exine smooth or tuberculate or verrucose.

Type: *Lepisorus thunbergianus* (Kaulf.) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 88 (1933).

### KEY TO SPECIES

- A. Lamina turning bright brown on drying;  
spores yellow, minutely verrucose ..... 1. **L. mehrae**
- A. Lamina turning green on drying; spores light-yellow, papillate and  
tuberculate or tuberculate-granulose.....B
- B. Lamina 6.0-25.0 x 0.5-1.0 cm, narrowly linear-lanceolate, apex long acuminate;  
texture thick, fleshy; veins obscure ..... 2. **L. nudus**
- B. Lamina 15.0-50.0 x 1.5-4.0 cm, linear

to broadly lanceolate, apex acute; texture

herbaceous, membranaceous; veins distinct.. ..... 3. **L. sesquedalis**.

1. **Lepisorus mehrae** Fras.-Jenk., New Sp. Syndrome Indian Pterid. & Ferns Nepal: 159 (1997); Chandra, Ferns India: 380 (2000).

*Lepisorus kashyapii* (Mehra) Mehra, Res. Bull. Panjab Univ. (n. s.) **13**: 23 (1962); Bir & Trikha, Bull. Bot. Surv. India **11**: 211 (1969); Chandra, J. Bombay nat. Hist. Soc. **74**: 648 (1979); Khullar *et al.*, in Western Him. **1**: 355 (1987); Pangtey & Punetha in Western Him. **1**: 407 (1987); Punetha & Kaur, J. Econ. Tax. Bot. **9**: 284 (1987); Pande & Basera, Indian Fern J. **5**: 158 (1988); Pande & Pande, Vegetos **3**: 57 (1990); Pande, Indian Fern J. **7**: 147 (1990); Khullar *et al.*, Ferns Nainital: 166 (1991).

*Polypodium kashyapii* Mehra, Ferns Muss.: 248 (1939), *nom. nud.*; Stewart, 150th Ann. Vol. Royal Bot. Gard. Calcutta **2**: 170 (1942).

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

*Lepisorus kashyapii* (Mehra) Mehra var. *minor* Bir & Satija, Amer. Fern J. **71**: 55 (1981); Satija & Bir, Aspects Pl. Sci. **8**: 23 (1985); Khullar, Him. Bot. Res.: 386 (1991); Khullar *et al.*, Ferns Nainital: 169 (1991).

*Lepisorus kashyapii* (Mehra) Mehra var. *major* Bir & Satija, Amer. Fern J. **71**: 55 (1981); Satija & Bir, Aspects Pl. Sci. **8**: 23 (1985); Khullar, Him. Bot. Res.: 386 (1991); Khullar *et al.*, Ferns Nainital: 169 (1991).

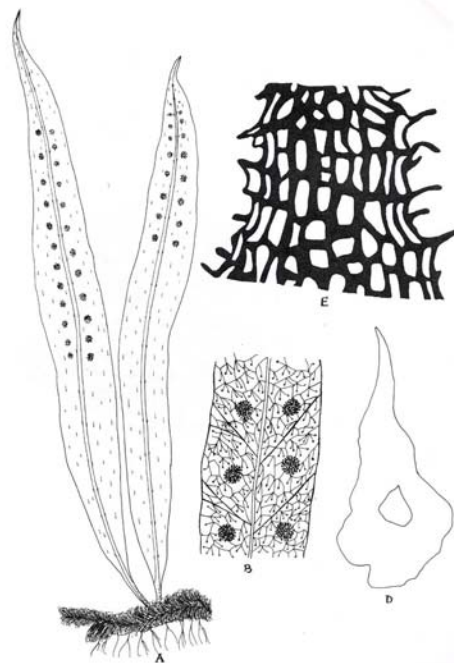


PLATE 6 A - *Lepisorus mehrae* Fras.-Jenk.: A = Plant; B = Magnified part of lamina  
D = Rhizome scale; E = Magnified part of rhizome scale

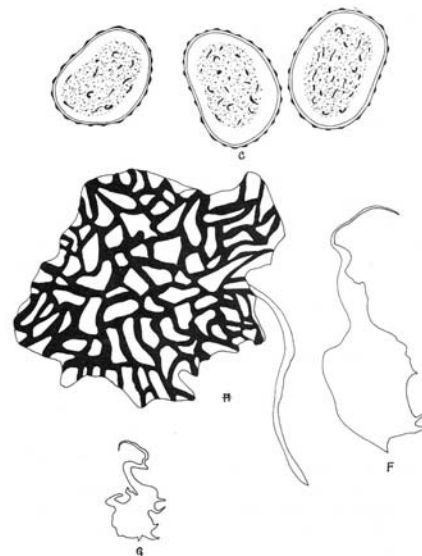


PLATE 6 B - *Lepisorus mehrae* Fras.-Jenk.: C = Spores; F = Stipe scale; G = Lamina  
scale; H = Paraphysis

Rhizome long-creeping, thick, loosely attached to the substratum by long straight robust roots, scaly; scales brown, base broad, margin toothed or fimbriate (with long filamentous projections), apex acuminate. Stipes 1-2 cm, distant on rhizome, usually clustered towards growing tip, forming a basket-like structure, stramineous to yellowish, scaly; scales brown, margin in the basal

part toothed, rest with long filamentous projections, lanceolate with a broad base and a long drawn out apex; rachis prominent on lower surface, stramineous, scaly, scales dark-brown, decreasing in size towards the apex, margin with prominent filamentous projections, apex acuminate, long drawn out. Lamina (12.0)-15.0 x 35.0 (-40.0) x 1.5-3.5 (-5.5) cm, broadly lanceolate, base gradually decurrent on stipe, apex acute, margin entire or slightly wavy; texture thick, subcoriaceous, bright brown on drying, lower surface scaly, scales dark-brown, contorted, deciduous; veins inconspicuous, anastomosing to form many irregular areolae with free simple or forked included veinlets. Sori not deeply immersed, round, large, submedial; paraphyses peltate, clathrate, subpersistent. Spores yellowish, 35 - 42 x 49 - 59  $\mu$ m, exine minutely verrucose. HABITAT: Commonly grows as a lithophyte, occasionally as an epiphyte. DISTRIBUTION: Fairly common from 2100-2500 m altitude.

UTTARAKHAND: NAINITAL: Nainital, Lariakanta, Khurpatal Tiffin Top, Pangtey's Gorge, Kilbury.

INDIA: Himachal Pradesh; Sikkim; Darjeeling; Meghalaya; Nagaland.

GENERAL DISTRIBUTION: Nepal.

2. **Lepisorus nudus** (Hook.) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 83 (1933); Bir & Trikha, Bull. Bot. Surv. India **11**: 265 (1969); Awasthi & Sharma, Proc. Indian Acad. Sci. (Pl. Sci.) **89**: 309 (1980); Dhir, Biblioth. Pterid. **1**: 124 (1980); Dhir & Sood, Biblioth. Pterid. **2**: 84 (1981); Verma & Khullar, Fern Gaz. **12**: 87 (1980); Goel & Bhattacharyya, Indian J. For. **4**: 36 (1981); Pangtey *et al.*, Him. Res. & Dev. **1**: 159 (1982); Bir *et al.*, Pterid. Fl. Garhwal Him.: 19 (1983); Pande *et al.*, Him. Res. & Dev. **3**: 40 (1984); Dixit, Census Indian Pterid.: 41 (1984); Satija & Bir, Aspects Pl. Sci. **8**: 18 (1985); Singh *et al.*, Indian J. For. **9**: 7 (1986); Khullar *et al.*, in Western Him. **1**: 356 (1987); Pangtey & Punetha in Western Him. **1**: 407 (1987); Punetha & Kaur, J. Econ. Tax. Bot. **9**: 284 (1987); Pande & Dashila, Indian Fern J. **5**: 87 (1988).

*Pleopeltis nuda* Hook., Exot. Fl.: t. 63 (1823); D. Don, Prodr. Fl. Nepal.: 3 (1825); Alston & Bonner, Candollea **15**: 208 (1936); Sledge, Bull. Brit. Nat. Hist. Soc. Bot. **2**: 135 (1960); Pande, Indian For. **99**: 52 (1973).

*Polypodium nudum* (Hook.) Kunze, Linnaea **23**: 281 (1850), *non* Forssk. (1786); Stewart, 150th Ann. Vol. Royal Bot. Gard. Calcutta **2**: 170 (1942); Chowdhury, Pterid. Fl. Upper Gangetic Plain: 69 (1973).

*Pleopeltis linearis sensu* Bedd., Handb. Ferns Brit. India: 346. t. 180 (1883), *non* Thunb. (1784); Mehra, Ferns Muss.: 75 (1939).

*Pleopeltis wightiana* (Thunb.) Bedd., Ferns Brit. India: 60. t. 180 (1863).

*Polypodium lineare sensu* Clarke, Trans. Linn. Soc. Lond. II (Bot.) **1**: 558 (1880); Hope, J. Bombay nat. Hist. Soc. **15**: 96 (1903); Duthie, Cat. Pl. Kumaun: 230 (1906).

*Lepisorus gyirongensis* Ching & S.K. Wu in C.Y. Wu Fl. Xizangica **1**: 304 (1983); Punetha & Kholia, New Botanist **16**: 117 (1989).

*Lepisorus intermedius* Ching & Khullar, Indian Fern J. **1**: 74 (1984).

*Lepisorus tenuipes* Ching & Khullar, Indian Fern J. **1**: 91 (1984); Pande & Kandpal, Acta Botanica Indica **14** (Suppl.): 121 (1986); Khullar *et al.*, in Western Him. **1**: 357 (1987); Pangtey & Punetha in Western Him. **1**: 408 (1987); Pande & Pande, Acta Botanica Indica **15**: 103 (1987); Pande & Basera, Indian Fern J. **7**: 148 (1990); Pangtey *et al.*, New Botanist **18**: 220 (1991); Khullar *et al.*, Ferns Nainital: 172 (1991).

*Lepisorus parvus* Khullar, Him. Res. & Dev. **7**: 59 (1994), *nom. nud.*

*Lepisorus pseudolinearis* Ching & Khullar, Him. Res. & Dev. **7**: 60 (1988), *nom. nud.*

*Lepisorus birii* Khullar, Him. Res. & Dev. **7**: 60 (1988), *nom. nud.*

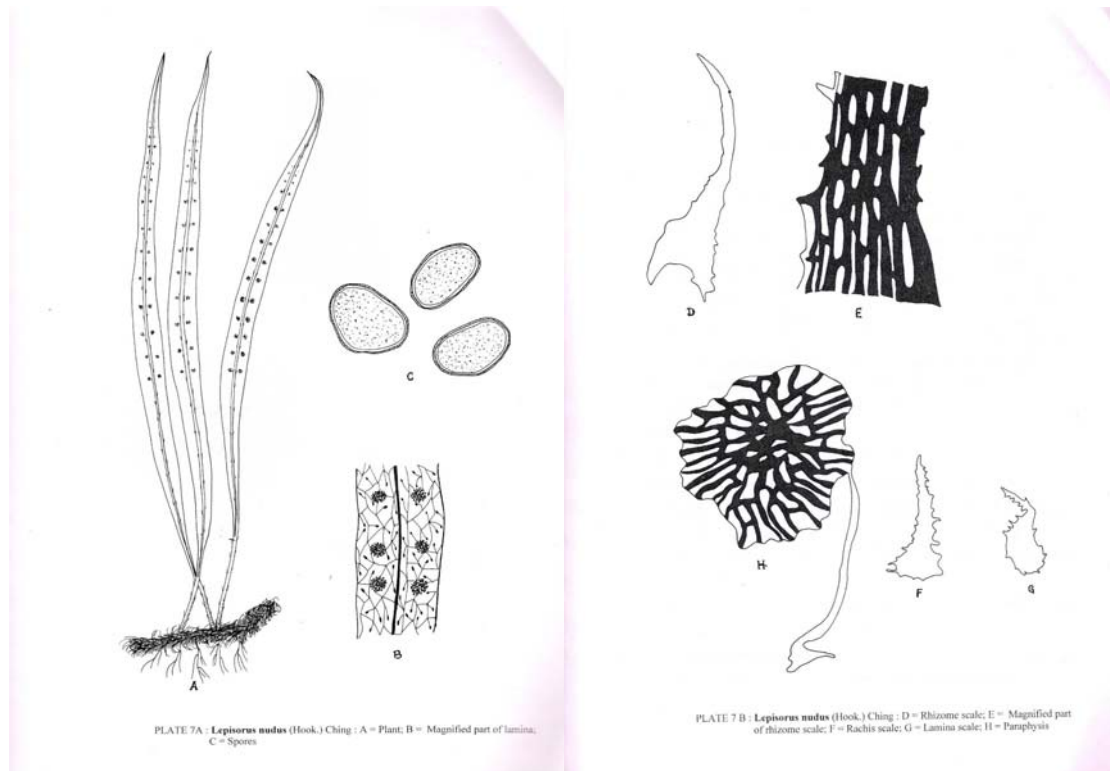


Rhizome long-creeping, thin, scaly; scales dark-brown, concolorous, laminae uniform, clear, isodiametric, base broad, margin toothed towards apex, almost entire below, often losing the apex when scales are older, apex acuminate or acute. Stipes 0.5-1.5 cm distant on rhizome, short, 0.5-3.0 cm long, sparsely scaly, scales as on rhizome; rachis prominent, sparsely scaly, scales deciduous. Lamina 6.0-25.0 x 0.5-1.0 cm, apex long acuminate, narrowly linear-lanceolate, base gradually attenuated and decurrent on stipe, apex long acuminate; texture thick, fleshy, glabrous; veins obscure, anastomosing to form 2-3 areolae, areolae with free simple or forked included veinlets. Sori round, large, medial but closer to the rachis, often confluent, covering the entire lamina between margin and rachis, more than half of the lamina fertile; paraphyses peltate, clathrate. Spores hyaline to yellowish, 35-49 x 59-70  $\mu\text{m}$ , exine smooth or minutely rugose.

HABITAT: Grows as an epiphyte as well as a lithophyte.

DISTRIBUTION: Not uncommon between 1000 and 3000 m altitude.

UTTARAKHAND: NAINITAL: Snow view, Nainital-Bhowali road, Khurpatal, Mangoli, Bajoon, Patuwadangar, Sattal, Bhimtal, Naukuchiatal, Jeolikote, Dogaon.



INDIA: Jammu & Kashmir; Himachal Pradesh; Sikkim; Darjeeling; Meghalaya; Nagaland; south India.

GENERAL DISTRIBUTION : Pakistan; Nepal; Bhutan; China; Japan; Thailand; Sri Lanka.

3. *Lepisorus sesquipedalis* (J. Smith) Fras.-Jenk., Bot. Helv. **102**(2): 153 (1992), *non Lepisorus sesquipedalis* (Wall. ex J. Smith) Fras.-Jenk., Pakistan Syst. **5**: 91 (1991); Khullar, Ill. Fern Fl. West Him. **1**: 109. t. 41 (1994); Chandra, Ferns India: 383 (2000).

*Drynaria sesquipedalis* J. Smith, Bot. Mag. 72 Comp.: 13 (1846).

*Polypodium sesquipedale* (J. Smith) Mett., Mem. Fam. Foug. **1**: no. 162 (1856).

*Polypodium scolopendrium* Buch.-Ham. ex D. Don. Prodr. Fl. Nepal.: **1** (1825), *nom. illeg. non*

- Polypodium scolopendrium* Burm. (1768).
- Polypodium excavatum* auct. India, non Bory (1810); Mehra, Ferns Muss.: 23 (1939); Stewart, 150th Ann. Vol. Royal Bot. Gard. Calcutta **2**: 170 (1942).
- Polypodium lineare* Clarke, Trans. Linn. Soc. Lond. II (Bot.) **1**: 558 (1880), *pro parte*.
- Pleopeltis simplex* Bedd., Handb. Ferns Brit. India: 347 (1883).
- Lepisorus excavatus* auct. Western Himalaya, non (Bory) Ching (1933); Bir & Trikha, Bull. Bot. Surv. India **11**: 273 (1969); Bir & Trikha, Amer. Fern J. **64**: 56 (1974); Chandra, J. Bombay nat. Hist. Soc. **74**: 648 (1979); Pangtey *et al.*, Him. Res. & Dev. **1**: 150 (1982); Bir *et al.*, Pterid. Fl. Garhwal Him.: 18 (1983); Pande *et al.*, Him. Res. & Dev. **3**: 40 (1984).
- Lepisorus excavatus* Bory var. *scolopendrium* (Ham. ex D. Don) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 69 (1933); Loyal & Verma, J. Bombay nat. Hist. Soc. **57**: 488 (1960); Dixit, Census Indian Pterid.: 40 (1984).
- Lepisorus scolopendrium* (Ham. ex D. Don) Mehra & Bir, Res. Bull. Panjab Univ. (n.s.) **15**: 168 (1964), *nom. nud.*; Pangtey & Punetha in Western Him. **1**: 408 (1987); Pande & Dashila, Indian Fern J. **5**: 87 (1988); Pangtey *et al.*, New Botanist **18**: 220 (1991); Khullar, Him. Res. & Dev. **7**: 60 (1988); Khullar *et al.*, Ferns Nainital: 170 (1991).
- Lepisorus leiopteris* auct. Western Himalaya, non (Kunze) Bir & Trikha, Amer. Fern J. **64**: 54 (1974); Pande & Kandpal, Acta Botanica Indica **14** (Suppl.): 121 (1986); Pangtey & Punetha in Western Him. **1**: 407 (1987).
- Lepisorus excavatus* Bory var. *mortonianus* Bir & Trikha, Amer. Fern J. **64**: 56 (1974); Dixit, Census Indian Pterid.: 40 (1984); Satija & Bir, Aspects Pl. Sci. **8**: 27 (1985); Pande, Indian Fern J. **7**: 147 (1990).
- Lepisorus excavatus* Bory var. *himalayensis* Bir & Trikha, Amer. Fern J. **64**: 58 (1974); Dixit, Census Indian Pterid.: 40 (1984); Pande, Indian Fern J. **7**: 147 (1990).
- Pleopeltis mortonianus* (Bir & Trikha) Love & Love, Taxon **26**: 324 (1977).
- Lepisorus scolopendrium* var. *himalayensis* (Bir & Trikha) Pangtey & Punetha in Western Him. **1**: 408 (1987).
- Lepisorus scolopendrium* var. *mortonianus* (Bir & Trikha) Pangtey & Punetha In Western Him. **1**: 408 (1987).
- Lepisorus himalayensis* (Bir & Trikha) Khullar, Him. Res. & Dev. **7**: 60 (1988); Him. Bot. Res.: 386 (1991).
- Lepisorus mortonianus* (Bir & Trikha) Khullar, Him. Res. & Dev. **7**: 60 (1988); Him. Bot. Res.: 386 (1991).
- Lepisorus kramerii* P. & H. Pande, Indian Fern J. **11**: 97 (1994), *nom. nud.*

Rhizome long-creeping, thick, woody, scaly; scales dark-brown, concolorous, central cells with dark coloured walls, uniformly thick, lanceolate, margin entire or slightly eroded, apex acuminate, laminae clear. Stipes c 0.2-2.0 cm distant on rhizome, 0.5-4.0 cm long, stramineous, sparsely scaly; scales as on rhizome, adpressed, deciduous; rachis prominent, scales as on stipe, adpressed, gradually decreasing in size. Lamina 15.0-50.0 x 1.5-4.0 cm, linear to broad lanceolate, base decurrent on stipe, apex acute, margin entire or slightly convolute; texture herbaceous, membranaceous when dry, lower surface scaly, scales darkbrown, small; veins distinct, anastomosing to form 4-5 areolae between margin and rachis, areolae with free simple or forked included veinlets. Sori immersed forming pustules on the surface, round, submedial, one between each main lateral vein; paraphyses peltate, clathrate. Spores yellowish-brown, 35.0-45.5 x 52.5-63.0 µm, exine sparsely tuberculate.

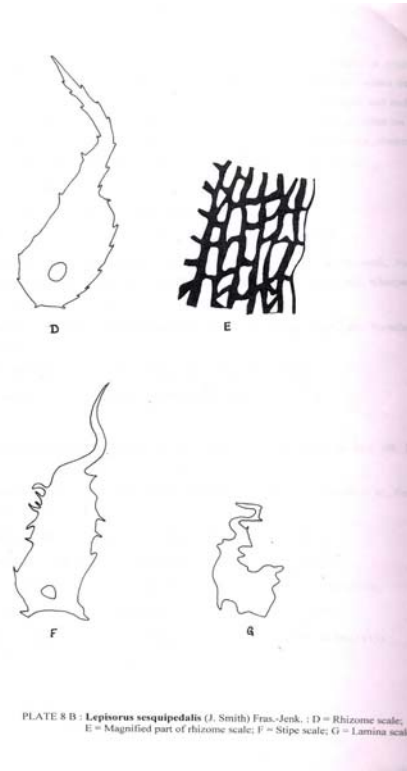
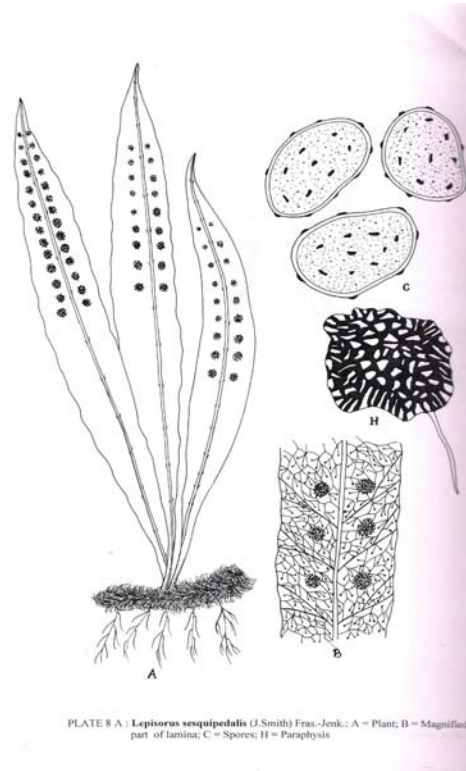
HABITAT: Grows as an epiphyte as well as a lithophyte in the forest.

DISTRIBUTION: A very common fern between 1800 and 3000 m altitude.

UTTARAKHAND: NAINITAL: Kilbury, Pangote, Pangtey's Gorge, Cheena peak, Snow View, Lariakanta, Dhobighat, Camels back, Land's end, Tiffin top, Khurpatal, Mangoli, Patawadhangar.

INDIA: Jammu & Kashmir; Himachal Pradesh; Sikkim; Darjeeling; Meghalaya; Nagaland; Tripura.

GENERAL DISTRIBUTION: Tibet; China; Nepal; Bhutan; N Thailand.



### Excluded / Doubtful Species

1. *Lepisorus amaurolepidus* (Sledge) Bir & Trikha, J. Bombay nat. Hist. Soc. **68**: 192 (1971).
2. *Lepisorus birii* Khullar, Him. Res. & Dev. **7**: 60 (1988), *nom. nud.*; Khullar *et al.*, Ferns Nainital: 164 (1991).
3. *Lepisorus excavatus* *auct.* Western Himalaya, *non* (Bory) Ching (1933).
4. *Lepisorus jakonensis* (Blanf.) Ching, Acta Bot. Yunnanica **5**: 5 (1883).
5. *Lepisorus kuchenensis* (Wu) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 89 (1933).
6. *Lepisorus leiopteris* (Kunze) Bir & Trikha, Amer. Fern J. **64**: 54 (1974).
7. *Lepisorus oligolepidus* (Bak.) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 66 (1933).
8. *Lepisorus scolopendrius* (Buch.-Ham. *ex* D. Don) Mehra & Bir, Res. Bull. Panjab Univ. (n.s.) **15**: 168 (1964).
9. *Lepisorus suboligolepidus* Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 77 (1933).
10. *Lepisorus tenuipes* Ching & Khullar, Indian Fern J. **1**: 91 (1984).
11. *Lepisorus ussuriensis* (Regel & Maack) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 91

(1933).

12. **Platygyria variabilis** Ching & S. K. Wu, Acta Bot. Yunnanica **5**: 21 (1983), *non Lepisorus variabilis* Ching & S.K. Wu in C.Y. Wu (= *Lepisorus clathratus*).
13. **Pleopeltis macrocarpa** (Bory ex Willd.) Kaulf., Berlin Jahrb. Pharm. **21**: 41 (1820).

## 6. MICROSORUM

*Microsorium* Link, Hort. Reg. Bot. Berol. **2**: 110 (1833); *emend.* Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 295 (1933).

*Acrostichum* L., Sp. Pl. **2**: 1067), *pro parte*.

*Phymatodes* Presl, Tent. Pterid.: 195 (1836); Nakai, Tokyo Bot. Mag. **43**:505 (1929), *pro parte*.

*Drynaria* J. Smith, J. Bot. **4**: 60 (1841), *pro parte*.

*Polypodium* D. Don, Prodr. Fl. Nepal.: 1 (1825); Mett., Polyp. : 86 (1857), *pro parte*.

*Polypodiwn* sect. *Phymatodes* Clarke, Trans. Linn. Soc. Lond. II (Bot.) **1**: 557 (1880); Hope, J. Bombay nat. Hist. Soc. **15**: 1903), *pro parte*.

*Pleopeltis* Moore, Index Fil. : 77 (1857); Bedd., Ferns Southern India (1864); Ferns Brit. India (1865); Handb. Ferns Brit. India: 357 (1883), *pro parte*.

Rhizome long or short-creeping, thick or thin, scaly but older portions becoming glabrous; scales dark-brown or black, lanceolate or ovate, peltate or basally attached, clathrate, margin entire or shortly toothed. Fronds isomorphic. Stipes approximate or distant, articulated to phyllopodia, long or short or even absent, lower surface rounded or grooved, upper flat, glabrous or hairy or scaly; rachis similar to stipe. Lamina simple, entire or deeply lobed, membranaceous or thick, herbaceous or subcoriaceous, glabrous or lower surface hairy; veins usually prominent, smaller transverse veins anastomosing to form areolae which contain smaller included areolae, ultimate areolae with free, simple or branched clavate, included veinlets in all directions, glabrous or hairy. Sori exindusiate, scattered or in 2-3 regular rows between lateral veins and several between margin and rachis, slightly or prominently sunk in the lamina; paraphyses filamentous, uniseriate, small, 2-4 celled, often with a terminal glandular cell, peltate clathrate scales absent. Spores bilateral, monoete, yellowish-brown, exine smooth or finely granulate, granulations arranged in a reticulate fashion.

Type: *Microsorium irregulare* Link, Hort. Reg. Bot. Berol. **2**: 110 (1833).

**Microsorium membranaceum** (D. Don) Ching, Bull. Fan Mem. Inst. Biol. Bot. **4**: 309 (1933); Pangtey *et al.*, Him. Res. & Dev. **1**: 159 (1982); Bir *et al.*, Pterid. Fl. Garhwal Him.: 23 (1983); Pande *et al.*, Him. Res. & Dev. **3**: 40 (1984); Dixit, Census Indian Pterid.: 45 (1984); Pande & Kandpal, Acta Botanica Indica **14** (Suppl.): 121 (1986); Khullar *et al.*, in Western Him. **1**: 357 (1987); Pangtey & Punetha in Western Him. **1**: 409 (1987); Punetha & Kaur, J. Econ. Tax. Bot. **9**: 285 (1987); Khullar *et al.*, Ferns Nainital: 173 (1991); Pangtey *et al.*, New Botanist **18**: 220 (1991); Khullar, Him. Res. & Dev. **7**: 60 (1988); Ill. Fern Fl. West Him. **1**: 121. t. 45 (1994); Chandra, Ferns India: 406 (2000).

*Polypodium membranaceum* D. Don, Prodr. Fl. Nepal.: 2 (1825); Clarke, Trans Linn. Soc. Lond. II (Bot.) **1**: 560 (1880); Hope, J. Bombay nat Hist. Soc. **15**: 93 (1903); C. Chr., Index Fil. **3**: 544 (1906); Mehra, Ferns Muss.: 26 (1939); Sterwart, 150th Ann. Vol. Royal Bot. Gard. Calcutta **2**: 170 (1942);

*Pleopeltis membranacea* Moore, Index Fil.: 191 (1860); Bedd., Handb. Ferns Brit. India: 335 (1883); Marten, J. Bombay nat. Hist. Soc. **19**: 182 (1909).

*Pleopeltis grandifolia sensu* Bedd., Ferns South. India: t. 177 (1864).

Rhizome short-creeping, thick, densely scaly but older portion glabrous; scales blackish

to dark - brown, lanceolate, margin entire, apex acuminate. Stipes 0.5-1.0 cm distant on rhizome or approximate, c 2-15 cm long or lamina decurrent almost up to the base, thick, stramineous, base scaly, rest glabrous; rachis rigid, prominent on lower surface, glabrous. Lamina simple, 30-100 x (2-) 4-6(-15) cm, lanceolate or oblanceolate, base gradually decurrent on stipe, apex attenuate, margin entire or wavy; texture thin, membranaceous, glabrous; veins distinct, lateral veins alternate, almost parallel reaching up to margin, glabrous, transverse veinlets many anastomosing to form many primary areolae which further contain smaller, irregular areolae, included veinlets many, free.

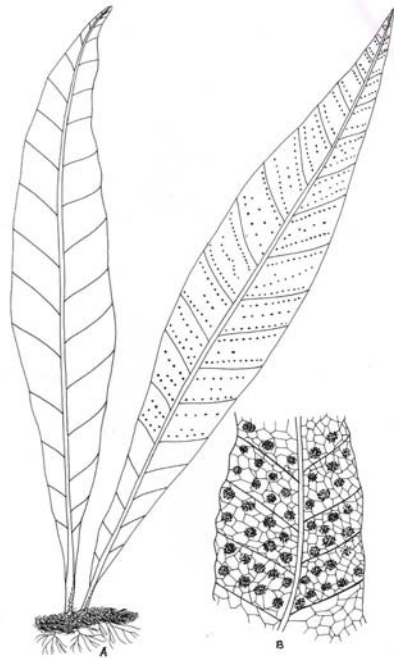


PLATE 9 A: *Microsorium membranaceum* (D. Don) Ching: A - Plant, B - Magnified part of lamina

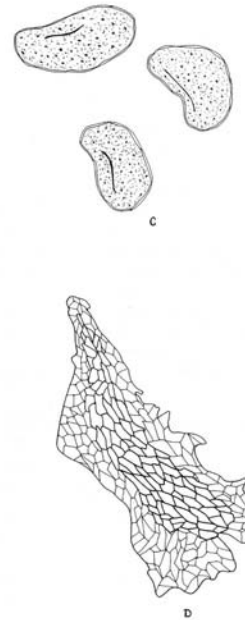


PLATE 9 B: *Microsorium membranaceum* (D. Don) Ching: C - Spores; D - Rhizome scale

Sori numerous, scattered, usually in 2 (-3) - 4(-7) parallel (or irregular) rows, 6-9 between margin and rachis, more or less irregularly subcontluent; paraphyses filamentous, uniseriate, short, 2-3 celled. Spores yellowish-brown, 28.0-38.0 x 44.5-52.5  $\mu\text{m}$ , exine minutely granulate.

**HABITAT:** Grows as a lithophyte on wet rocks along river banks and besides water-falls or in forest as an epiphyte.

**DISTRIBUTION:** Fairly common from 1500-2700 m altitude.

**UTTARAKHAND:** NAINITAL: Dhobighat, Jeolikote, Bhimtal, Mangoli, Bagoon, Dogaon.

**INDIA:** Jammu & Kashmir; Himachal Pradesh; Sikkim; Darjeeling; Assam; Arunachal Pradesh; Meghalaya; Nagaland; Manipur; central India; Pachmarhi hills; south India: Mahabaleshwar; Khandala; Purandar.

**GENERAL DISTRIBUTION:** Nepal; Bhutan; Tibet; China; Taiwan; Vietnam; Thailand; Philippines; Sri Lanka.

## 7. PHYMATOPTERIS

*Phymatopteris* Pich. Serm., *Webbia* 28: 460 (1973).

*Phymatopsis* J. Smith, *Hist. Fil.* : 104 (1875).

Rhizome long-creeping, dictyostelic, thick or thin, fleshy, scaly; scales brown, generally



bicolorous, linear-lanceolate or broad lanceolate or suborbicular or subulate peltate, attached towards base, margin fimbriate with very long (ciliate) projections. Fronds isomorphic, rarely dimorphic. Stipes articulated to the rhizome, stramineous to light-brown; rachis usually glabrous or sometimes scaly. Lamina simple, deeply pinnatifid (or simple, trifid, palmatifid or pinnate), deeply lobed to the rachis; texture coriaceous or herbaceous, lower surface glabrous, bluish-green, sometimes hairy, upper glabrous, often glaucous, glabrous; main and lateral veins distinct; veinlets anastomosing to form irregular areolae with or without free included veinlets with swollen tips. Sori exindusiate, large, distinct, oval or round, in a row on either side of the main vein and one between the lateral veins or irregularly biseriate, superficial or slightly sunk; paraphyses simple, 2-7 celled, terminal often glandular. Spores bilateral, monolete, non-perinate, exine smooth, granulate or spiny.

Type: *Phymatopteris palmata* (Blume) Pich. Serm., *Webbia* **28**: 460 (1973).

#### KEY TO SPECIES

- A. Lamina lobes triangular lanceolate, bases broad, margin minutely serrate or minutely serrulate lower pair generally downwardly deflexed ..... 1. **P. oxyloba**
- A. Lower lobes linear lanceolate, bases decurrent, margin entire, lowest pair ascending or deflexed ..... 2. **P. quasidivariata**
1. **Phymatopteris oxyloba** (Wall. ex Kunze) Pich. Serm., *Webbia* **28**: 464 (1973); Pande *et al.*, *Him. Res. & Dev.* **3**: 40 (1983); Bir *et al.*, *Pterid. Fl. Garhwal Him.*: 22 (1983); Dixit, *Census Indian Pterid.*: 50 (1984); Satija & Bir, *Aspects Pl. Sci.* **8**: 62 (1985); Khullar *et al.*, in *Western Him.* **1**: 358 (1987); Pangtey & Punetha in *Western Him.* **1**: 409 (1987); Pande & Pande, *Acta Botanica Indica* **15**: 103 (1987); Pande & Dashila, *Indian Fern J.* **5**: 88 (1988).
- Polypodium oxylobum* Wall. ex Kunze, *Linnaea* **24**: 255 (1851); Hope, *J. Bombay nat. Hist. Soc.* **15**: 94 (1903); Duthie, *Cat. Pl. Kumaun*: 230 (1906); Stewart, *150th Ann. Vol. Royal Bot. Gard. Calcutta* **2**: 169 (1942).
- Pleopeltis oxyloba* (Wall. ex Kunze) Bedd., *Ferns South. India*: t. 175 (1863).
- Polypodium hastatum* (Thunb.) Pich. Serm. var. *oxyloba* (Wall. ex Kunze) Clarke, *Trans. Linn. Soc. Lond. II (Bot.)* **1**: 563 (1880).
- Polypodium trifidum* D. Don. *Prodr. Fl. Nepal.*: 3 (1825), *non* Hoffm. (1790); Hook. & Baker, *Syn. Fil.*: 363 (1868).
- Pleopeltis trifida* (Smith) Bedd., *Handb. Ferns Brit. India Suppl.*: 96 (1892).
- Phymatodes oxyloba* (Wall. ex Kunze) Ching, *Contr. Inst. Bot. Nat. Acad. Peiping* **2**: 67 (1933); Bir & Devi, *Bull. Bot. Surv. India* **10**: 207 (1968); Loyal & Verma, *J. Bombay nat. Hist. Soc.* **57**: 488 (1960); Verma & Khullar, *Fern Gaz.* **12**: 88 (1980); Dhir, *Biblioth. Pterid.* **1**: 127 (1980);
- Crypsinus oxylobum* (Wall. ex Kunze) Sledge, *Bull. Brit. Mus. Nat. Hist. Bot.* **2**: 145 (1960).
- Phymatopsis oxylobus* (Wall. ex Kunze) Ching, *Acta Phytotax. Sin.* **9**: 190 (1964).

Rhizome long-creeping, thick, scaly; scales bicolorous, linear-lanceolate, margin fimbriate with long projections, apex acuminate. Stipes c 2 cm distant on rhizome, 9-11 cm long, never longer than the lamina, stramineous, firm, erect, glabrous but extreme base scaly; scales as on rhizome; rachis glabrous. Lamina simple, pinnatifid, 15 -50 x 15 - 25 cm, ovate-lanceolate, base decurrent, margin deeply lobed, 0.5-1.0 cm to the rachis; texture subcoriaceous, glabrous; lobes linear-lanceolate, apex acuminate, margin not cartilaginous, entire, terminal lobe 6-9 x 1 -2 cm, as long as the lateral ones, 3-5 (-8) pairs, alternate 9.0-11.0 x 2.5 (-5.0), lowest pair or the one above it is the largest, ascending or deflexed; sinus 1.0-1.5 cm; veins anastomosing, areolae with or without included veinlets. Sori round, submedial, in a row on either side of the main vein

and one in between the lateral vein lets. Spores yellowish-brown, 31.5-35.0 x 56.0-66.5  $\mu\text{m}$ , non-perinate, exine spinulose.

**HABITAT:** Grows as an epiphyte as well as a lithophyte.

**DISTRIBUTION:** An occasional in the west, but common to abundant in Kumaun between 1300 and 3600 m altitude.

**UTTARAKHAND: NAINITAL:** Bhowali, Kainchi, Bhimtal, Sattal, way to Ratighat, Bajoon, Mangoli, Patuwadangar, Jeolikote.

**INDIA:** Himachal Pradesh; Sikkim; Darjeeling; Meghalaya; Nagaland.

**GENERAL DISTRIBUTION:** Nepal; Bhutan; SW China; Nepal; Bhutan; Taiwan; Vietnam; Thailand.

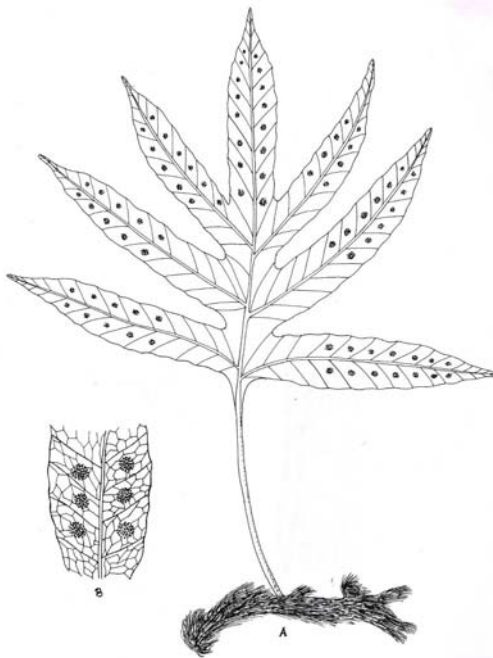


PLATE 10 A : *Phymatopteris oxyloba* (Wall. ex Kunze) Pichl Serrn.: A = Plant, B = Magnified part of lamina

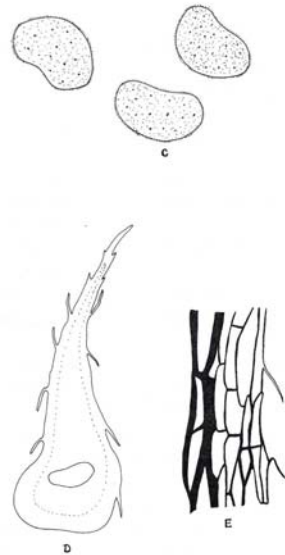


PLATE 10 B : *Phymatopteris oxyloba* (Wall. ex Kunze) Pichl Serrn.: C = Spores; D = Rhizome scale; E = Magnified part of rhizome scale

2. ***Phymatopteris quasidivariata*** (Hayata) Pich. Serrn., *Webbia* **28**: 464 (1973); Dixit, *Census Indian Pterid.*: 50 (1984); Chandra, *Ferns India*: 417 (2000).

*Polypodium quasidivariatum* Hayata, *J. Coll. & Univ. Tokyo* **30**: 446 (1911). *Phymatopsis quasidivariata* (Hayata) H.Ito, *J. Jap. Bot.* **11**: 100 (1935).

*Crypsinus quasidivariatus* (Hayata) Copel., *Gen. Fil.*: 266 (1947).

*Phymatopteris stracheyi* (Ching) Pich. Serrn., *Webbia* **28**: 464 (1973); Bir *et al.*, *Pterid. Fl. Garhwal Him.*: 22 (1983); Dixit, *Census Indian Pterid.*: 50 (1980); Satija & Bir, *Aspects Pl. Sci.* **8**: 59 (1985); Singh *et al.*, *Indian J. For.* **9**: 8 (1986); Khullar *et al.*, in *Western Him.* **1**: 358 (1987); Pangtey & Punetha in *Western Him.* **1**: 409 (1987); Punetha & Kholia, *New Botanist* **16**: 118 (1989).

*Phymatodes stracheyi* Ching, *Contr. Inst. Bot. Nat. Acad. Peiping* **2**: 83 (1933); Bir, & Devi, *Bull. Bot. Surv. India* **10**: 204 (1968); Chandra, *J. Bombay nat. Hist. Soc.* **74**: 648 (1979);

Dhir, Biblioth. Pterid. 1: 127 (1980); Verma & Khullar. Fern Gaz. 12: 88 (1980).

*Polypodium stracheyi* Ching in C. Chr., Index Fil. Suppl. 3: 159 (1934); Stewart. 150th Ann. Vol. Royal Bot. Gard. Calcutta 2: 169 (1942).

*Phymatopsis stracheyi* Ching, Acta Phytotax. Sin. 9: 195 (1964).

*Crypsinus stracheyi* Panigr. & Patnaik, Proc. Nat. Acad. Sci. India 34B: 482 (1964).

Rhizome long-creeping, thin, scaly; scales bicolorous, lanceolate, soft, margin fimbriate with long projections, apex acuminate. Stipes 1-2 cm distant on rhizome, 8-10 long, stramineous, thin, firm, glabrous but extreme base scaly, scales as on rhizome; rachis glabrous. Lamina simple, pinnatifid, 10-15 x 10-15 cm, deltate or narrowly elongate, lanceolate, margin long, deeply lobed; texture subcoriaceous, glabrous; lobes triangular lanceolate, base broad, apex acuminate, margin minutely serrate or serrulate, teeth neither mucronate nor spinescent, terminal lobe 7-9 x 1 cm, as long as lateral ones, lateral pairs 3-4 pairs, opposite to alternate, lowest pair downwardly deflexed, acuminate; veins anastomosing forming 2-3-series of areolae with free included veinlets. Sori round, close to the main vein, in a row on either side of it; paraphyses small, 2-celled, simple, hair-like. Spores dark - brown, 24.5-35.0 x 42.0-56.0  $\mu\text{m}$ , non-perinate, exine granulose.

HABITAT: Grows both as an epiphyte and lithophyte.

DISTRIBUTION: Rare around 1800 m altitude and above.

UTTARAKHAND: NAINITAL: Nainital-way to Kilbury.

INDIA: Himachal Pradesh; Sikkim; Darjeeling.

GENERAL DISTRIBUTION: Tibet; China; Taiwan.



PLATE 11. *Phymatopteris quasidivariata* (Hayata) Pichi Serm. A = Plant; B = Magnified part of lamina; C = Spores; D = Rhizome scale; E = Magnified part of rhizome scale.

**Excluded / Doubtful Species**

1. *Phymatopteris hastata* (Thunb.) Pich. Serm., *Webbia* **28**: 462 (1973).

### 8. POLYPODIODES

*Polypodiodes* Ching, *Acta Phytotax. Sin.* **16(4)**: 26 (1978).

*Polypodium* L., *Sp. Pl.* 2: 1082 (1753), *emend.* Ching, *Contrib. Inst. Bot. Nat. Acad. Peiping* **2**: 31(1933).

*Polypodium* sect. *Eupolypodium* Hook. ex Baker, *Syn. Fil.*: 319 (1868); *C.Chr., Index Fil.* : 506 (1905).

*Goniophlebium* (Blume) C. Presl, *Tent. Pterid.*: 185 (1836); *Bedd., Ferns Brit. India*: t. 87.( 1866-69); *Ferns Brit. India Suppl.* :1867); *Handb. Ferns Brit. India*: 317 (1883).

*Polypodium* sect. *Goniophlebium* Blume, *Fl. Jav. Fil.* : 132 (18280); *Clarke, Trans. Linn. Soc. Lond. II (Bot.)* **1**: 550 (1880); *Hope, J. Bombay nat. Hist. Soc.* **15**: 85 (1903).

Rhizome long-creeping, dictyostelic, brown or dark-brown, densely scaly becoming glabrous with age; scales dark-brown to blackish, ovate-lanceolate or subulate-lanceolate, glaucous, cells moderately large, clear, almost isodiametric, basifixed or peltate with a broad lower half, margin entire or fimbriate with a short or long projections, apex acute or sometimes long hair pointed. Fronds isomorphic. Stipes distant on rhizome, articulated to the rhizome with prominent pseudopodia; rachis hairy and / or scaly or glabrous. Lamina simple, pinnatifid, imparipinnate, triangular-lanceolate to linear-lanceolate; texture herbaceous to subcoriaceous, glabrous or more or less hairy; lobes simple, confluent at their bases, lower 1 or 2 rarely free, reduced, distant towards deflexed, broadly adnate, articulated or not to the rachis pinnae; veins forked, free or generally anastomosing to form one (rarely two) rows of costal areolae; areolae subhexagonal with one free simple excurrent veinlet, marginal veins free. Sor exindusiate, generally in a row on either side of the costa, round or oblong, glabrous or with dimorphic paraphyses (simple or peltate). Spores light-brown or yellowish, bilateral, monolete, subreniform or ovoid, perinate or non-perinate, smooth or slightly tuberculate.

Type: *Polypodiodes amoena* (Wall. ex Mett.) Ching, *Acta Phytotax. Sinica* **16**: 27 (1978).

#### KEY TO SPECIES

- A. Fronds large, robust; rhizome thick, dia. 0.4-0.5 cm; lamina lobes more than 8 cm long; texture thick,  
subcoriaceous: rachis generally scaly throughout ..... 1. **P. amoena**
- A. Fronds small, delicate; rhizome thin, dia. 0.1-0.2 (-0.4) cm; lamina lobes not more than 2.5 cm long; texture thin, herbaceous; rachis sparsely scaly;  
scales restricted to lower half ..... B
- B. Rhizome scales hair-like, many black; lamina lobes  
numerous, often more than 30 ..... 2. **P. lachnopus**
- B. Rhizome scales narrow but not hair-like, all  
brown; lamina lobes seldom more than 30 ..... 3. **P. microrrhizoma**

1. **Polypodiodes amoena** (Wall. ex Mett.) Ching, *Acta Phytotax. Sin.* **16(4)**: 27 (1978); *Khullar et al.*, in *Western Him.* **1**: 358 (1987); *Pangtey & Punetha in Western Him.* **1**: 408 (1987); *Pande, Geobios new Reports* **8**: 109 (1989); *Indian Fern J.* **7**: 149 (1990); *Khullar et al.*, *Ferns Nainital*: 182 (1991); *Pangtey et al.*, *New Botanist* **18**: 220 (1991).

*Polypodium amoenum* Wall. ex Mett., *Uber Farngatt.* **1**: 80 (1857); *Clarke, Trans. Linn. Soc. Lond. II (Bot.)* **1**: 550 (1880); *Hope, J. Bombay nat. Hist. Soc.* **14**: 85 (1903); *Duthie, Cat. Pl. Kumaun*: 230 (1906); *Mehra, Ferns Muss.*: 21 (1939); *Stewart, 150th Ann. Vol. Royal Bot. Gard. Calcutta* **2**: 169 (1942); *Bir et al.*, *New Botanist* **1**: 149 (1974); *Chandra, J. Bombay nat. Hist. Soc.* **74**: 649 (1979);

*Polypodium aureum* D.Don. Prodr. Fl. Nepal.: 3 (1825), *non* L (1753).

*Goniophlebium amoenum* J.Smith in Hook. Gen. Fil.: ad t. 50 (1840); Bedd., Handb. Ferns Brit. India: 317 (1883); Marten, J. Bombay nat. Hist. Soc. **19**: 182 (1909); Singh *et al.*, Indian J. For. **9**: 7 (1986); Chandra, Ferns India: 389 (2000).

*Polypodium valdealatum* Christ. Bull. Herb. Boiss. **7**: 4 (1899).

*Polypodium amoenum* Wall. *ex* Mett. var. *latedeltoideum* Christ. Bull. Acad. Geogr. Bot.: 142 (1907).

*Polypodium amoenum* Wall. *ex* Mett. var. *xerophyticum* Mehra & Bir, Res. Bull. Panjab Univ. (n.s.) **15**: 166 (1964).

*Polypodium amoenum* Wall. *ex* Mett. var. *pinnatifidum* Dhir, Biblioth. Pterid. **1**: 119 (1980), *nom. nud.*

Rhizome long-creeping, thick, densely scaly; scales dark-brown, adpressed, ovate-acuminate or lanceolate-subulate, base broad, margin entire or slightly eroded. Stipes distant on rhizome, *c* 30 cm long, stramineous to light-brown, thick, robust, scaly at extreme base, rest glabrous, scales as on rhizome; rachis stramineous or brown, lower surface scaly throughout, scales as on rhizome, but smaller; upper surface hairy, hyaline. Fronds robust. Lamina pinnatifid, large, up to 60 x 25 cm, triangular-lanceolate, apex acuminate; texture thick, herbaceous to subcoriaceous; lobes many, *c* 40 pairs, 10 x 1 cm, horizontal, lanceolate, base broad, apex acuminate, margin distantly dentate-serrate or irregularly lobed, lower most lobes generally free, horizontal or downwards deflexed; veins prominent, anastomosing to form a row of costal areolae, sometimes in two rows in larger fronds, costal arches of rachis continued nearly or quite to the base of the fronds, costal arches of the main rachis continued nearly or quite to the base of the frond; costa lower surface scaly, upper hairy; costules upper, surface hairy, lower glabrous. Sori round or oval, medial, on the included veinlet in the costal areolae, in a single row on either side of the costa; paraphyses peltate. elathrate, short stalked.. Spores light-yellow; 24.5 - 38.5 x 45.5 - 66.8  $\mu$ m, exine minutely tuberculate.



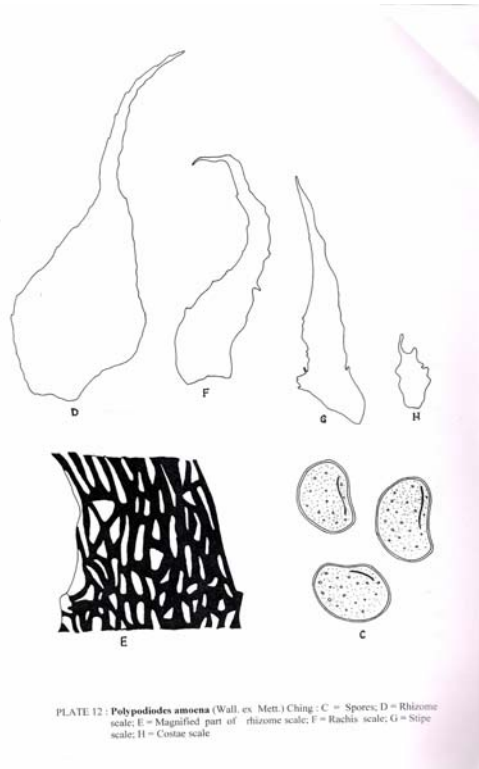


PLATE 12: *Polypodiodes amoena* (Wall. ex Mett.) Ching: C = Spores; D = Rhizome scale; E = Magnified part of rhizome scale; F = Rachis scale; G = Stipe scale; H = Costae scale

**HABITAT:** Grows as a lithophyte; sometimes as a foot epiphyte.

**DISTRIBUTION:** Common and sometimes abundant between 1800 and 2400 m altitude.

**UTTARAKHAND:** NAINITAL: Cheena peak, Kilhury, Pangtey's Gorge, Dhohighat, Lariakanta, Tiffin top, Camel's back.

**INDIA:** Jammu & Kashmir; Himachal Pradesh; Sikkim; Darjeeling; Meghalaya; Nagaland; Manipur.

**GENERAL DISTRIBUTION:** Nepal; Bhutan; Tibet; China; Taiwan; Vietnam; Philippines; Myanmar; N Thailand.

2. ***Polypodiodes lachnopus*** (Wall. ex Hook.) Ching, Acta Phytotax. Sin. **16**(4): 27 (1978); Dixit, Census Indian Pterid.: 52 (1984); Singh *et al.*, Indian J. For. **9**: 8 (1986); Khullar *et al.*, in Western Him. **1**: 358 (1987); Pangtey & Punetha in Western Him. **1**: 408 (1987); Pande, Geobios new Reports **8**: 109 (1989); Indian Fern J. **7**: 150 (1990); Khullar *et al.*, Ferns Nainital: 183 (1990); Pangety *et al.*, New Botanist **18**: 220 (1990).

*Polypodium lachnopus* Wall. ex Hook., Icon. Pl.: t. 952 (1854); Clarke, Trans. Linn. Soc. Lond. II (Bot.) **1**: 551 (1880); Hope, J. Bombay nat. Hist. Soc. **15**: 86 (1903); Duthie, Cat. Pl. Kumaun: 230 (1906); Mehra, Ferns Muss.: 22 (1939); Bir *et al.*, New Botanist **1**: 150 (1974); Loyal & Verma, J. Bombay nat. Hist. Soc. **57**: 488 (1960); Chandra, J. Bombay nat. Hist. Soc. **74**: 649 (1979); Verma & Khullar, Fern Gaz. **12**: 88 (1980); Dhir, Biblioth. Pterid. **1**: 121 (1980).

*Polypodium vulgare* D. Don, Prodr. Fl. Nepal.: 2 (1825), *non* L. (1753).

*Goniophlebium lachnopus* (Wall. ex Mett.) J. Smith in Hook. Gen. Fil.: ad t. 51 (1840); Bedd., Handb. Ferns Brit. India: 319 (1883); Marten, J. Bombay nat. Hist. Soc. **19**: 182 (1909); Pande, Indian For. **99**: 52 (1973); Chandra, Ferns India: 391 (2000).

Rhizome long-creeping, thin, densely scaly; scales black, iridescent with oblongovate base, subulate, margin fimbriate with prominent short and long projections, apex long, spreading,

hair pointed. Stipes 0.5-2.0 cm distant on rhizome, short, 6.0-15.0 cm long, stramineous, thin, sparsely hairy, hairs hyaline, short, 2-3-celled, very sparsely scaly, scales few, as on rhizome; rachis hairy, hairs on the lower surface short, 1-2-celled, upper surface more hairy, hairs longer, moderately scaly, scales nearly orbicular, apex long, cuspidate or setiform. Lamina simple, pinnatifid, 15-50 x 3-7 cm, linear-lanceolate, margin deeply lobed nearly to the rachis; texture herbaceous, hairy, hairs as on rachis; lobes many, 30-60 pairs (rarely below 30), 1.0 - 2.5 x 5.0 - 0.8 cm, margin remotely crenate-serrate, apex subacuminate, lower most lobes at times free and downwards deflexed; veins anastomosing to form a series of large costal areolae with simple included veinlets, marginal veins free rarely united, such marginal areolae without free included veinlets; costae and costules hairy, hairs hyaline, short, costa scaly, scales short, orbicular.. Sori small, round, in a single row on either side of the costa and one between each costal areolae; paraphyses peltate, clathrate, long stalked, margin stellate. Spores pale, 31.5 - 42.0 x 52.0 - 66.0  $\mu\text{m}$ , perinate, perine smooth.

**HABITAT:** Grows as an epiphyte and as a lithophyte.

**DISTRIBUTION:** Fairly common between 1800 and 2400 m altitude.

**UTTARAKHAND: NAINITAL:** Nainital, Land's end, Nainital-Bhowali road, Dhobighat, Pangtey's Gorge, Kilbury.

**INDIA:** Jammu & Kashmir; Himachal Pradesh; Sikkim; Darjeeling; Meghalaya; Nagaland; Manipur.

**GENERAL DISTRIBUTION:** Nepal; Bhutan; Tibet; China.

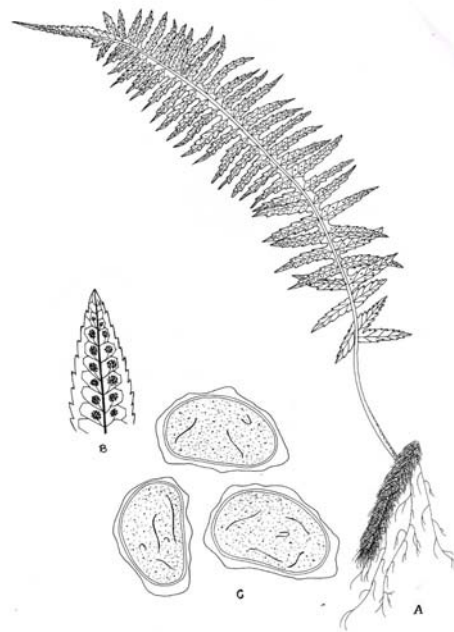


PLATE 13 A: *Polypodiodes lachnopus* (Wall. ex Hook.) Ching: A = Plant; B = Magnified part of lamina; C = Spores

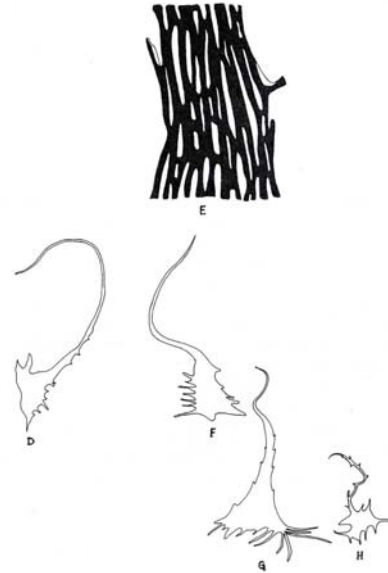


PLATE 13 B: *Polypodiodes lachnopus* (Wall. ex Hook.) Ching: D = Rhizome scale; E = Magnified part of rhizome scale; F = Rachis scale; G = Costae scale; H = Stipe scale

3. ***Polypodiodes microrhizoma*** (Clarke ex Baker) Ching, Acta Phytotax. Sin. **16**(4): 27 (1978); Dixit, Census Indian Pterid.: 52 (1984); Singh *et al.*, Indian J. For. **9**: 8 (1986); Khullar *et al.*, in Western Him. **1**: 359 (1987); Pangtey & Punetha in Western Him. **1**: 408 (1987); Pande, Geobios new Reports **8**: 109 (1989); Indian Fern J. **7**: 130 (1990); Pande & Pande, Vegetos **3**: 57 (1990); Pangtey *et al.*, New Botanist **18**: 220 (1991).

*Polypodium microrhizoma* Clarke ex Baker in Hook. & Baker Syn Fil ed. **2**: 511 (1874); Clarke, Trans. Linn. Soc. Lond. II (Bot.) **1**: 551 (1880); Hope, J. Bombay nat. Hist. Soc. **15**: 86 (1903); Duthie, Cat. Pl. Kumaun: 230 (1906); Mehra, Ferns Muss.: 22 (1939); Bir *et al.*, New Botanist **1**: 147 (1974).

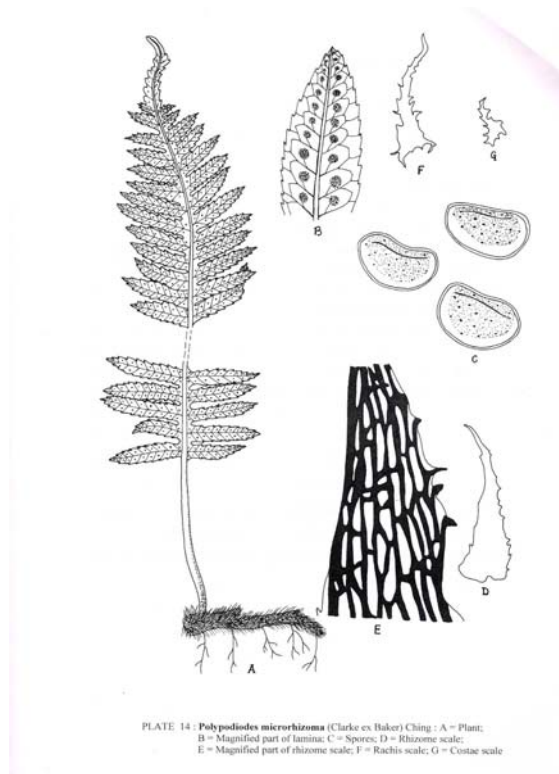
*Goniophlebium microrhizoma* (Clarke ex Baker) Bedd., Ferns Brit. India Suppl.: 21. t. 384 (1876); Handb. Ferns Brit. India: 322 (1883); Loyal & Verma, J. Bombay nat. Hist. Soc. **57**: 488 (1960); Chandra, Ferns India: 392 (2000).

*Polypodium taliense* Christ, Bull. Soc. Bot. Fr. Mem. **1**: 14 (1905).

*Polypodium microrhizoma* Clarke ex Baker var. *xerophyticum* Mehra, Ferns Muss.: 22 (1939), *nom. nud.*: Dhir, Biblioth. Pterid. **1**: 120 (1980); Bir *et al.*, Pterid. Fl. Garhwal Him.: 17 (1983); Satija & Bir, Aspects Pl. Sci. **8**: (1985).

Rhizome long-creeping, thin, scaly; scales dark-brown, lanceolate, margin fimbriate with short projections, apex acuminate. Stipes 2-4 cm distant on rhizome, 10-20 cm long, stramineous or castaneous brown, thin, glaucous, glabrous; rachis castaneous brown or stramineous, glaucous, generally glabrous or occasionally very sparsely scaly, scales few scattered, brown, small, lanceolate. Lamina simple, pinnatifid, 15-20 x 5-8 cm, linear, narrow, lanceolate, apex acuminate, deeply lobed almost to the rachis; texture membranaceous, herbaceous, glabrous; lobes 20-25 pairs, 3.0-4.0 x 0.3-0.5 cm, lanceolate, margin serrate or distantly incised, lower most lobes sometimes free, distant, slightly smaller than the next two or three pairs above; veins anastomosing to form a single series of costal areolae but free towards apex of the lobes, costal arches of the main rachis usually broken at least in the lower half of the lamina; costae and costules glabrous, costa rarely with a few scales but generally glabrous. Sori round or oval,

medial on the included or free veinlets, nearer the costa, in a single row on either side of costa; paraphysesplattate, clathrate, also simple 2-celled ones. Spores light-yellowish, 24.5-31.5 x 49.0-56.0  $\mu\text{m}$ , perinate, perine narrow, smooth.



**HABITAT:** Grows as an epiphyte and as a lithophyte.

**DISTRIBUTION:** Very common or abundant from 1500- 2700 m altitude.

**UTTARAKHAND:** NAINITAL: Dhobighat, Lariakanta, Snow View, Cheena peak range, Tiffin top, Khurpatal, Patuwadhangar, Jeolikote, Bhimtal, way to Ratighat.

**INDIA:** Jammu & Kashmir; Himachal Pradesh; Sikkim; Darjeeling; Meghalaya; Nagaland.

**GENERAL DISTRIBUTION:** Nepal; Bhutan; Tibet; SW China; Taiwan; Thailand; N Myanmar.

#### Excluded / Doubtful Species

**1. *Polypodiodes subamonea*** (Clarke) Ching, Acta Phytotax. Sin 16(4): 27 (1987).

*Polypodium subamoenum* Clarke, Trans. Linn. Soc. Lond. II (Bot.) 1: 550 t. 82. f. 2 (1880). *Goniophlebium subamoenum* (Clarke) Bedd., Handb. Ferns Brit. India: 317 (1883); Chandra, Ferns India: 394 (2000).

#### 9. PYRROSIA

*Pyrrosia* Mirbel in Lamarch & Mirbel Hist. Pl. 4: 70 (1803); Hist. Nat. Veg. 5: 91 (1803).

*Polypodium* Sw. in Schard. J. Bot. 1800(2): 21 (1801).

*Cyclophorus* Desv., Berl. Mag. 5: 30 (1811).

*Niphobolus* Kaulf., Enum. Fil.: 24 (1824), *nom. superfl.*; Bedd., Ferns Southern India: t. 240 (1863); Ferns Brit. India: t. 161 (1865-1870); Handb. Ferns Brit. India: 324- 332 (1883).

*Polypodium* sect. *Niphobolus* Hook., Sp. Fil. 5: 43 (1863); Clarke, Trans. Linn. Soc. Lond II (Bot.) 1: 552 (1880); Hope, J. Bombay nat. Hist. Soc. 15: 87 (1903).

Rhizome long or short-creeping, thick or thin, densely scaly; scales concolorous or bicolorous, generally paleate. Fronds isomorphic, rarely dimorphic. Stipes distant or clustered, articulate at base, or stipe indistinct, hairy; hairs stellate, generally caduceous; rachis usually prominent, at times sunken, hairy. Lamina simple, linear-lanceolate or ovate, margin entire, rarely hastately or palmately lobed; texture generally and glossy with age, provided with pit-like or punctuate hydathodes arranged in rows, lower surface hairy, hairs generally brown or hyaline, stellate, uniform or dimorphic, generally in two layer of straight, acicular (thin), curly and intertwined or lanceolate (thick), broad and flat, stalked, lower layer of irregularly coiled arms; hairs lighter coloured or hyaline, arms long, coiled or hairs mixed (both type or arms on the same hair), their number in a hair variable; veins generally obscure or lateral veins prominent, copiously anastomosing, areolae with many free simple branched or unbranched included veinlets; veinlet ends clavate. Sori exindusiate, in one, two or three or multiseriate rows between rachis and margin, acrostichoid, distributed over a large area of the lower surface, superficial or partly immersed in pits, round, rarely oblong; paraphyses absent. Spores bilateral, monoletic, generally large, exine thin, smooth or sparsely verrucose, occasionally the thin outer layer of exine may become loose on soaking and peel off.

Type: *Pyrrosia chinensis* Mirbel. Hist. Nat. Veg. 5: 92 (1803).

#### KEY TO SPECIES

A. Stipes distinct. 5-20 cm long, lamina base rounded or unequally hastate, both halves decurrent to a

short distance on stipe ..... 1. **P. flocculosa**

A. Stipes indistinct or very short, rarely up to 2 cm long; lamina base gradually tapered, decurrent on stipe ..... B

B. Rhizome scale margin entire, smooth ..... 2. **P. mannii**

B. Rhizome scale margin toothed or imbricate ..... 3. **P. porosa**

I. **Pyrrosia flocculosa** (D. Don) Ching, Bull. Chinese Bot. Soc. 1: 66 (1935); Mehra, Ferns Muss.: 26 (1939); Loyal & Verma, J. Bombay nat. Hist. Soc. 57: 488 (1960); Bir *et al.*, Pterid. Fl. Garhwal Him.: 20 (1983); Pande *et al.*, Him. Res. & Dev. 3: 40 (1984); Satija & Bir. Aspects Pl. Sci. 8: 43 (1985); Hovenkamp, Leiden Bot. series 9: 179 (1986); Pangety & Punetha in Western Him. 1: 407 (1987); Pande & Dashila, Indian Fern J. 5: 86 (1988); Pande, Geobios new Reports 8: 169 (1989); Indian Fern J. 7: 151 (1990); Khullar *et al.*, Ferns Nainital: 187 (1991); Ill. Fern Fl. West Him. 1: 160. t. 59 (1994); Chandra, Ferns India: 365 (2000).

*Polypodium flocculosum* D. Don, Prodr. Fl. Nepal.: 1 (1825); Hooker & Baker, Syn. Fil.: 351 (1867); Clarke, Trans. Linn. Soc. Lond. II (Bot.) 1: 554 (1880); Hope, J. Bombay nat. Hist. Soc. 15: 88 (1903); Duthie, Cat. Pl. Kumaun: 230 (1906).

*Polypodium tomentosum* Roxb. in Griff., Calc. J. Nat. hist. 4: 483 (1844), *non* Thomas, *nec* Bory.

*Niphobolus detergibilis* (Hook.) Bedd., Ferns Brit. India: t. 162 (1863).

*Polypodium detergibile* Hook., Sp. Pl. 5: 49 (1863).

*Niphobolus flocculosus* (D. Don) Spreng., Syst. Veg. 4: 45 (1827); Bedd., Ferns Brit. India: t. 62 (1866); Handb. Ferns Brit. India: 331. t. 180 (1883).

*Cyclophorus flocculosus* (D. Don) C. Chr., Index Fil.: 199 (1905); Stewart, 150th Ann. Vol. Royal Bot. Gard. Calcutta 2: 170 (1942); Chowdhury, Pterid. Fl. Upper Gangetic Plain: 73



(1973).

Rhizome short-creeping, thick, densely scaly, scales brown, lanceolate, margin entire or slightly fimbriate, apex acuminate, hair pointed. Stipes approximate 0.3-0.5(-1.0) cm distant on rhizome, 5-20 cm long, shorter than lamina, stout, thick, densely hairy; hairs light brown, arms needle-like, size variable, stalked, stalk 3-4-celled, armed hairs hyaline, arms closely coiled; rachis hairy, hairs as on stipe. Lamina simple, 7-25 (-35) x 2-3 (-8) cm, lanceolate or oblong-lanceolate, base rounded or unequally hastate, one-half ending before the other or both halves decurrent on stipe, apex acuminate, margin entire or undulate; texture succulent-coriaceous, lower surface brown or greyish - white, densely hairy, upper surface bright-green, hairy; veins immersed; costules indistinct, main lateral veins faintly raised on lower surface, oblique, anastomosing 10 form 10-15 areolae on either side of rachis. Sori immersed, many, round, small or slightly spreading along veinlets, in distinct regular rows between main lateral veins. Spores yellowish, 52.5-59.5 x 66.5-87.5  $\mu\text{m}$ , exine smooth or faintly verrucose.

HABIT AT: Grows both as an epiphyte as well as lithophyte.



PLATE 15: *Pyrrhosia flocculosa* (D. Don) Ching: A = Plant; B = Magnified part of lamina; C = Spores; D = Rhizome scale; E = Magnified part of rhizome scale; F & G = Hairs

DISTRIBUTION: Common in the region from 1300-2100 m altitude.

UTTARAKHAND: NANITAL: Nainital, Khurpatal, Jeolikote, Gogaon, Ranobagh, Kathgodam, Bhimtal area, Mangoli, Bagoon, way to Ratighat.

INDIA: Jammu (Kathua); Himachal Pradesh; Sikkim; Darjeeling; Siliguri; Assam; Arunachal Pradesh; Meghalaya; Nagaland; Manipur; Tripura.

GENERAL DISTRIBUTION: Nepal; Bhutan; Thailand; Vietnam; Myanmar; Bangladesh.

2 *Pyrrhosia mannii* (Gies.) Ching, Bull. Chinese Bot. Soc. **1**: 55 (1935); Dhir, Biblioth. Pterid. **1**: 117 (1980); Satija *et al.*, Bull. Bot. Surv. India **25**: 81 (1983); Dixit, Census Indian Pterid.: 55 (1984); Satija & Bir, Aspects Pl. Sci. **8**: 44 (1985); Hovenkamp, Leinden Bot. series **9**: 212 (1986); Pangtey & Punetha in Western Him. **1**: 407 (1987); Pande, Indian Fern J. **7**: 151 (1990); Khullar, Him. Res. & Dev. **7**: 61 (1988); Ill. Fern Fl. West Him. **1**: 165. t. 61 (1994); Khullar *et al.*, Ferns Nainital: 188 (1991); Chandra. Ferns India: 369 (2000).

*Niphobolus mannii* Gies., Farngett. Niph.: 107 (1801).

*Polypodium fissum sensu* Clarke, Trans. Linn. Soc. Lond. II (Bot.) 1: 554 (1880); Duthie, Cat. Pl. Kumaun: 230 (1906), *non* (Blume) Baker in Baker & Hooker (1867).

*Niphobolus fissus sensu* Hook., Sp. Fil. 5: 48 (1863); Bedd., Handb. Ferns Brit. India: 330 (1883), *pro parte, non* Blume (1828).

*Niphobolus floccigerus sensu* Bedd., Ferns Brit. India Suppl.: 22. t. 386 (1876), *non* Blume (1828).

*Pyrrosia fissa sensu* Mehra, Ferns Muss.: 26 (1939), *non* (Bl.) Mehra. (1939). *Cyclophorus porosus* C.Chr., Index Fil.: 200 (1905). *pro parte*; Stewart, 150th Ann. Vol. Royal Bot. Gard. Calcutta 2: 170 (1942).

Rhizome short-creeping, thick, scaly; scales brown, concolorous, lanceolate, margin entire, apex acuminate. Stipes approximate, 0.1-0.3 cm distant on rhizome, very short, c 1 cm long or none, light-brown, hairy; hairs light-brown to dark-brown, arms acicular, size variable, stalked, stalk long, c 8-celled, coiled-armed hairs light-brown to almost hyaline, mixed hairs with very short straight arms and a few long coiled ones; rachis hairy, hairs ason stipe. Lamina 15.0-45.0 x 1.0-1.5 cm, oblanceolate or lanceolate or linear lanceolate, base long attenuate gradually narrowed and extending almost to the very base of stipe, apex acute or acuminate, margin entire, sometimes irregular or even pinnately lobed; texture herbaceous, lower surface densely hairy, upper surface sparsely hairy; veins indistinct; veinlets anastomosing to form c 8-areolae on either side of rachis; areolae with 36 free, mostly unbranched included veinlets. Sori immersed, round, scattered in irregular rows. Spores yellowish, 38.5-52.5 x 52.5-84.0  $\mu\text{m}$ , exine almost smooth or with sparse subglobose verrucae.

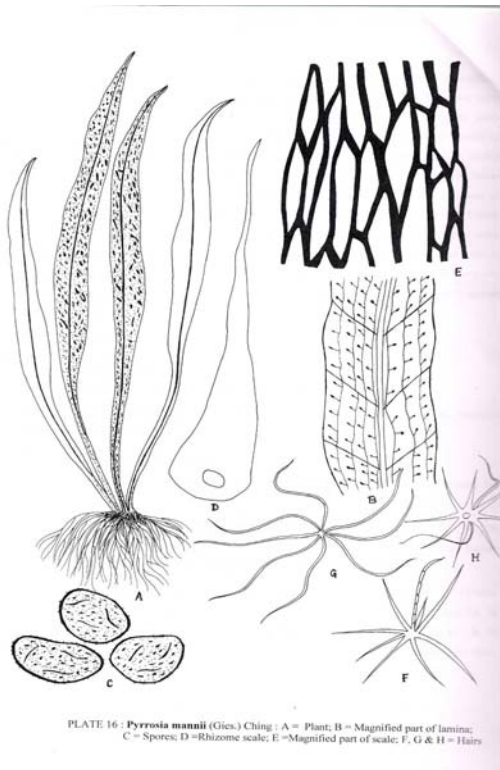


PLATE 16: *Pyrrisia mannii* (Gies.) Ching : A = Plant; B = Magnified part of lamina; C = Spores; D = Rhizome scale; E = Magnified part of scale; F, G & H = Hairs

**HABITAT:** Grows as an epiphyte.

**DISTRIBUTION:** Occasional between 800 and 1500 m altitude.

UTTARAKHAND: NAINITAL: below Dhobighat, Dogaon to Jeolikote, Sattal, Bhimtal area, Mangoli-Kaladhungi road, Ramgarh.

INDIA: Sikkim; Darjeeling; Meghalaya; Nagaland; Tripura.

GENERAL DISTRIBUTION: Nepal; Bhutan; China; Thailand; Malaysia; Myanmar; Sri Lanka.

3. ***Pyrrosia porosa*** (Presl) Hovenkamp, *Blumea* **30**: 208 (1984); *Leiden Bot. Ser.* **9**: 226 (1986); Fraser-Jenkins, *Pakistan Syst.* **5**: 91 (1992); *New Sp. Syndrome Indian Pterid. & Ferns Nepal*: 232 (1997); Chandra, *Ferns India*: 372 (2000).

*Pyrrosia stictica* (Kunze) Holtt., *Novit. Bot. Inst. Carol. Prag.* **1968**: 31 (1969); Verma & Khullar, *Fern Gaz.* **12**: 88 (1980); Satija *et al.*, *Bull. Bot. Surv. India* **25**: 76 (1983); Dixit, *Census Indian Pterid.*: 56 (1984); Satija & Bir, *Aspects Pl. Sci.* **8**: 50 (1985); Hovenkamp, *Leiden Bot. series* **9**: 218 (1986); Khullar *et al.*, in *Western Him.* **1**: 359 (1987); Pangtey & Punetha in *Western Him.* **1**: 407 (1987); Pande & Dashila, *Indian Fern J.* **5**: 86 (1988); Pande, *Indian Fern J.* **7**: 151 (1990); Khullar *et al.*, *Ferns Nainital*: 189 (1990); Pangtey *et al.*, *New Botanist* **18**: 220 (1991); Khullar, *Him. Res. & Dev.* **7**: 61 (1988); *III. Fern Fl. West Him.* **1**: 169. t. 63 (1994).

*Niphobolus sticticus* Kunze, *Linnaea* **24**: 257 (1851).

*Polypodium sticticum* (Kunze) Mett., *Polyp.*: 128 (1856).

*Polypodium porosum* (Presl) Wall. *ex Mett.*, *Polyp.*: 128 (1856).

*Niphobolus fissus sensu* Bedd., *Ferns Brit. India*: II (1870); *Handb. Ferns Brit. India*: 330 (1883). *non* Blume (1828).

*Niphobolus porosus* Presl, *Tent. Pterid.*: 200 (1836).

*Niphobolus mollis sensu* Nayar & Chandra, *Canad. J. Bot.* **45**: 615-634 (1967). *non* Kunze (1848); Chandra, *Ferns India*: 369 (2000).

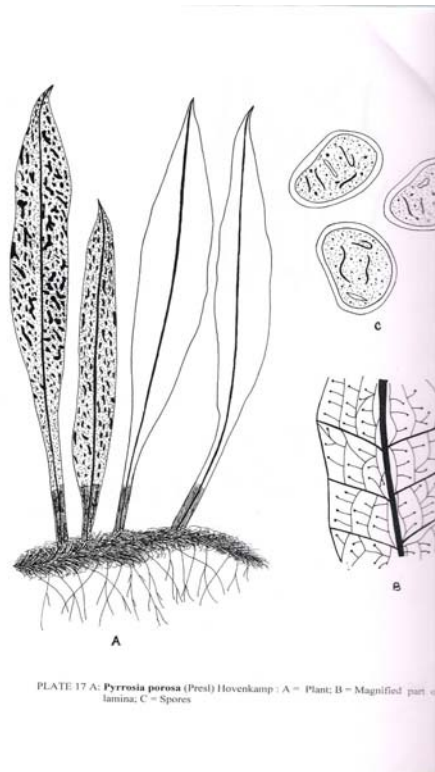
*Cyclophorus porosus* (Presl) Presl, *Epim. Bot.*: 130 (1851); Stewart, *150th Ann. Vol. Royal Bot. Gard. Calcutta* **2**: 170 (1942).

*Cyclophorus sticticus* (Kunze) C.Chr., *Index Fil.*: 201 (1905).

*Pyrrosia mollis sensu* Nayar & Chandra, *Bull. Nat. Bot. Gard. Lucknow* **117**: 67 (1965); *Canad. J. Bot.* **45**: 615-634 (1967); Dhir, *Biblioth. Pterid.* **1**: 116 (1980); Dhir & Sood, *Biblioth. Pterid.* **2**: 85 (1981); Pangtey *et al.*, *Him Res. & Dev.* **1**: 160 (1982); Satija *et al.*, *Bull. Bot. Surv. India* **25**: 76 (1983); Dixit, *Census Indian Pterid.*: 55 (1984); Singh *et al.*, *Indian J. For.* **9**: 9 (1986); Punetha & Kaur, *J. Econ. Tax. Bot.* **9**: 283 (1987).

*Pyrrosia nayariana* Ching & Chandra, *Amer. Fern J.* **54**: 62 (1964); Satija *et al.*, *Bull. Bot. Surv. India* **25**: 81 (1983); Dixit, *Census Indian Pterid.*: 55 (1984); Satija & Bir, *Aspects Pl. Sci.* **8**: 49 (1985); Khullar *et al.*, *Ferns Nainital*: 188 (1991); Khullar, *Him. Res. & Dev.* **7**: 61 (1988); *III. Fern Fl. West Him.* **1**: 167. t. 62 (1964).

Rhizome short-creeping, thin, scaly; scales dark-brown with an almost blackish central region, lanceolate, surface hairy, margin fimbriate, filamentous projections long, basal part toothed, apex acute or acuminate, not hair pointed. Stipes approximates very short or none or not clearly demarcated, light-brown, hairy; hairs persistent, light-brown; rachis hairy, hairs as on stipe. Lamina simple, 10.0 - 18.0 (-30.0) x 0.5 - 1.0 (-2.0) cm, oblanceolate or lanceolate or linear-lanceolate, base long attenuated gradually narrowed and extending almost to the very base, nearly as long as rest of the lamina, apex acute, margin entire; texture herbaceous or succulent-coriaceous, lower surface light-brown to dark-brown, densely hairy, upper surface deeply punctuate, bright green, glossy at maturity, hairy, hairs as on rachis; veins indistinct; veinlets anastomosing to form 3-5-areolae on either side of rachis, areolae with 2 or 3 free unbranched veinlets. Sori immersed, comparatively large, round, scattered in irregular rows. Spores yellowish, large, 42.0-66.5 x 84.0-94.5  $\mu\text{m}$ , verrucose, verrucae subglobose, non-perinate.



**HABITAT:** Grows as an epiphyte or occasionally as a lithophyte. **DISTRIBUTION:** A rather common fern from 1500-2200 m altitude.

**UTTARAKHAND:** NAINITAL: Mangoli-Kaladhungi road, Gola valley, Dogaon, between Dogaon and Jeolikote, Bhujiahat, way to Ratighat.

**INDIA:** Jammu & Kashmir; Himachal Pradesh; Sikkim; Darjeeling; Meghalaya; Manipur; Tripura; Tamil Nadu; Kodaikanal; Nilgiri hills; Kerala.

**GENERAL DISTRIBUTION:** Pakistan; Nepal; Bhutan; China; Taiwan; S Japan; Thailand; Vietnam; Laos; Myanmar; Sri Lanka.

#### **Excluded/Doubtful Species**

1. ***Pyrrrosia mollis*** (Kunze) Ching, Bull. Chinese Bot. Soc. **1**: 53 (1935). *Niphobolus mollis* Kunze, Bot. Zeit. **6**: 121 (1848).
2. ***Pyrrrosia nayariana*** Ching & P. Chandra, Amer. Fern J. **54**: 62 (1964).
3. ***Pyrrrosia pannosa*** (Mett. ex Kuhn) Ching, Bull. Chinese Bot. Soc. **1**: 58 (1935). *Polypodium pannosum* Mett. ex Kuhn, Linnaea **36**: 141 (1869).

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