

PTERIDOPHYTIC FLORA OF MANDAKINI VALLEY IN GARHWAL HIMALAYA*¹

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ABSTRACT

The present report is based on the field collections made by one of us (BNM) during the years 1972-1977 while working on the flora of the Mandakini valley, situated between 30° and 30° 45'N and 78° 75' and 79° 75'E, extending from 600 m to 4200 m above the mean sea level in the Western part of Chamoli district, Uttar Pradesh, India. Supplementing the earlier work, 60 species of ferns and fern allies representing 35 genera, belonging to 11 families have been additionally enumerated.

INTRODUCTION

Mandakini valley with its varied climate, mountainous topography and altitudinal zones extending from tropical, temperate to alpine, possess luxuriant and rich pteridophytic flora, terrestrial as well as epiphytic. However, so far, no serious effort had been made to study this fascinating group of plants. Rau (1961) listed 21 species of ferns and their allies from this valley along with the dominant group of Angiosperms. Recently, during Madyamaheshwar and Tungnath expeditions, a preliminary record of ferns was made from Mandakini valley by Chandra (1979).

The present communication dealing with the ferns and fern allies is based on extensive collections made by one of us

(BNM) during the years 1972-1977, while working on the flora of Mandakini valley. The account dealing with the other groups of plants (Angiosperms, Gymnosperms) will appear elsewhere. The fern families and genera are arranged following Copeland's system of classification (Copeland, 1947), except in case of Thelypteridaceae where genera are arranged according to Holttum (1971). Upto date nomenclature of most of the species is based on Nayar and Kaur's companion to Beddome (1974).

Some species though already recorded earlier by Chandra (1979) from the Mandakini valley, have also been included in the present communication so as to have their range of altitudinal distribution. The voucher specimens of all the species

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studied are deposited in the herbarium of the Central Drug Research Institute, Lucknow.

TOPOGRAPHY

Mandakini valley is situated in the Western part of Chamoli district in Uttarakhand Division, Uttar Pradesh, India. The area explored lies between 30° and 30° 45' N and 78° 75' and 79° 75' E, extending from 600 m-4200 m above mean sea level and is mountainous. The river Mandakini arises from Chorabari glacier (Ranjan & Srivastava, 1975), locally called "Brahmagupha". From the origin of the river beyond Kedarnath, several streams near Kedarnath and below join the main stream, the river covers a distance of about 90 km before its confluence with the Alaknanda at Rudraprayag. The alignment of the valley is North-South. In the extreme North of the valley lies perpetual snow.

Because of the varying topographical features, the valley shows considerable variation in altitude, terrain and climatic conditions. But in general it is under the influence of monsoonic climate. Therefore, the heaviest precipitation occurs during the period of June-September. From December to March the weather is cold. Snowfall usually occurs from November to March (above 3000 m). Below this and up to 2000 m snowfalls from December to February. Snowfall up to 2400 m is slight and it melts soon, but above 2400 m it is moderate to heavy depending upon the terrain and altitude and it remains there for about six months but starts melting in the following summer.

ENUMERATION OF SPECIES

EQUISETACEAE

Equisetum Linn.

E. arvensis Linn.; Clarke in Trans. Linn. Soc. II. Bot. 1 : 594 (1880).

Common along streams and water channels near Kedarnath, 3500 m (BNM 3325, 4509).

E. diffusum D. Don; Chowdhury, Pterid. Flora Upper Gang. Plain 12 (1973).

Occuring frequently at marshy places in Phata 1500 m. and Guptakashi 1300 m (BNM 3663, 4934).

SELAGINELLACEAE

Selaginella Beauv.

S. involvens (Sw.) Spring; Panigrahi & Dixit in J. Indian bot. Soc. 46: 229 (1967).

Very common on moist rocks in Agustmuni forest, 800 m (BNM 4957, 5858).

S. subdiaphana (Wall.) Spring; Chowdhury, Pterid. Flora Upper Gang. Plain 6 (1973).

Spreading over rocks at moist and humid places near Phata, 1500 m (BNM 4963).

LYCOPODIACEAE

Lycopodium Linn.

L. hamiltonii Spring; Clarke in Trans. Linn. Soc. II Bot. 1 : 590 (1880).

Frequently occurring on moss covered tree trunks in Phata 1500 m and Sonprayag-Tolipani 1800 m forests (BNM 4975, 3592).

L. setaceum Hamilt. in Don Prodr. Fl. Neapl, 18, 1825; Mehra & Bir, in Res. Bull. (N. S.) Punjab Univ. 15 : 101, 1964.

A common epiphyte on mossy trees in Phata 1500 m and Gaurikund 2000 m forests (BNM 3995, 4962, 4873).

SCHIZAEACEAE

Lygodium Swartz

L. flexuosum (Linn.) Swartz; Nayar & Kaur, companion to Beddome: 104 (1974).

Quite frequent, hanging from rocks in Agustmuni forest, 700 m (BNM 3878).

L. japonicum (Thunb.) Sw.; Nayar & Kaur, companion to Beddome: 104 (1974).

Creeping on rocks, common in Batwalchhari, 900 m (BNM 5002).

PTERIDACEAE

Adiantum Linn.

A. capillus-veneris Linn.; Nayar & Kaur, companion to Beddome: 23 (1974).

Common on moist rocks along streams in Guptakashi 1300 m, Agustmuni 700 m and Batwalchhari 900 m forests (BNM 3639, 3842, 3903).

A. incisum Linn.; Nayar & Kaur, companion to Beddome: 23 (1974).

Common on roadside rocks at Agustmuni, 700 m (BNM 3833).

A. venustum D. Don; Nayar & Kaur, companion to Beddome: 23 (1974).

Common on rocks and tree trunks in Rambara forest, 2700 m and between Garurchatti to Kedarnath, 3000-35000 m (BNM 4666, 4756).

Cheilanthes Swartz

C. farinosa (Forsk.) Klf.; Nayar & Kaur, companion to Beddome: 25 (1974).

Common on dry rocks in Agustmuni, 700 m (BNM 3709).

C. pteridioides (Reich.) C. Chr.; Nayar & Kaur, companion to Beddome: 24 (1974).

Quite common on trees in Rambara, 2700 m (BNM 4758).

Cryptogramma R. Br.

C. crispa R. Br. ex Hook.; Nayar & Kaur, companion to Beddome: 27 (1974).

Rare, occurring in alpine meadows in sheltered pockets near Gandhisarovar, 3900 m (BNM 5366).

Gymnopteris Bernhardi

G. vestita (Wall.) Und.; Nayar & Kaur, companion to Beddome: 92 (1974).

Common in Sonprayag forest, 1800 m occasionally as epiphyte on trees (BNM 4867).

Microlepia Presl

M. strigosa (Thunb.) Presl; Nayar & Kaur, companion to Beddome: 19 (1974).

Rare. plants scarcely distributed in Guptakashi forest, 1300 m (BNM 3963).

Onychium Kaulfuss

O. contiguum (Wall.) Hope; Nayar & Kaur, companion to Beddome: 27 (1974).

Common in moist grassy slopes between Rambara—Garurchatti, 2850 m (BNM 4710).

O. japonicum (Thunb.) Kunze; Nayar & Kaur, companion to Beddome: 27 (1974).

Common on moist slopes in Phata forest, 1500 m (BNM 5821).

Pteris Linn.

P. cretica Linn.; Nayar & Kaur, companion to Beddome: 29 (1974).

Common in *Quercus-Rhododendron* forest near Phata, 1500 m (BNM 3948).

DAVALLIACEAE

Leucostegia Presl

L. delavayi (Bedd. ex Clarke & Bak.) Ching; Nayar & Kaur, companion to Beddome: 16 (1974).

A rare epiphyte in Rambara forest, 2700 m (BNM 4757).

L. pseudocystopteris (Kze.) Bedd.; Nayar & Kaur, companion to Beddome: 16 (1974).

A rare epiphytic species occurring in Gaurikund—Rambara forest, 2500 m (BNM 4763).

Nephrolepis Schott.

N. cordifolia (Linn.) Presl; Nayar & Kaur, companion to Beddome: 69 (1974).

A common species on shady hill slopes at Agustmuni, 700 m (BNM 3866).

ASPIDIACEAE

Athyrium Roth

A. anisopterum C. Chr.; Nayar & Kaur, companion to Beddome: 40 (1974).

Frequently found as epiphyte on trees, also on rocks in Sonprayag-Gaurikund forest, 1800 m (BNM 4869).

A. atkinsoni Bedd.; Nayar & Kaur, companion to Beddome: 39 (1974).

Common along water streams at Kedarnath, 3500 m (BNM 4537).

A. fimbriatum (Wall.) Moore; Nayar & Kaur, companion to Beddome: 42 (1974).

Occurring frequently at shady and humid places in the forests between Gaurikund-Rambara, 2500 m (BNM 4770).

A. mackinnoni (Hope) C. Chr.; Nayar & Kaur, companion to Beddome: 40 (1974).

A rare species, found by the side of water streams between Gaurikund-Rambara, 2500 m (BNM 4767).

A. pectinatum (Wall.) Presl; Nayar & Kaur, companion to Beddome: 42 (1974).

Frequent in *Quercus*-*Rhododendron* forests between Sonprayag-Gaurikund, 1800 m (BNM 4868).

A. schimperi Moug. ex Fee; Nayar & Kaur, companion to Beddome: 42 (1974).

Frequent on slopes in Gaurikund-Rambara forests, 2400 m (BNM 4766).

A. thelypteroides (Michx.) Desv.; Nayar & Kaur, companion to Beddome: 49 (1974).

Common in alpine meadows near Kedarnath, 3500 m (BNM 4571).

Cyrtomium Presl

C. caryotideum (Wall. ex Hook. et Grev.) Pr.; Nayar & Kaur, companion to Beddome: 50 (1974).

Rare, occasionally found in *Quercus*-*Rhododendron* forests near Phata, 1500 m (BNM 8630).

Diplazium Swartz

D. polypodioides Bl.; Nayar & Kaur, companion to Beddome: 44 (1974).

Common near streams and water channels in the forest of Gaurikund-Rambara, 2300 m (BNM 4769).

Dryopteris Adanson

D. barbigera (Hook.) O. Ktze.; Nayar & Kaur, companion to Beddome: 59 (1974).

Common in Kedarnath, 3500 m (BNM 5447).

D. paleacea (Sw.) C. Chr.; Fl. E. Himal. 477 (1966).

A distinct elegant species occurring at some what exposed places in Rambara forest, 2700 m (BNM 4755).

D. sparsa (Ham. ex Don) O. Ktze.; Nayar & Kaur, companion to Beddome: 61 (1974).

Frequently occurring on the hill slopes between Gaurikund-Rambara, 2400 m (BNM 4762).

Polystichum Roth

P. nepalense (Sprengel) C. Chr.; Nayar & Kaur, companion to Beddome: 48 (1974).

Not very common. Sparsely distributed in the forests of Gaurikund and Rambara, 2400 m (BNM 3523).

P. prescottianum (Wall. ex Mett.) Moore; Nayar & Kaur, companion to Beddome: 49 (1974).

Common in glacial valley at Vasuki-Tal, 4000 m and Mahapanth, 4200 m (BNM 5434, 5472).

P. setiferum (Forsk.) Moore ex Woynar; Nayar & Kaur, companion to Beddome: 49 (1974).

Quite common in Agustmuni, 700 m, Betwalchari, 900 m and Phata, 1500 m, forests (BNM 3845, 3923, 3980).

P. stimulans Pr.; Nayar & Kaur, companion to Beddome: 48 (1974).

Frequently occurring in rock crevices in Rambara forest, 2500 m (BNM 3525).

Tectaria Cav.

T. cicutaria (Linn.) Copel.; Nayar & Kaur, companion to Beddome: 52 (1974).

Occurring at moist shady places in the forest of Batwalchari, 900 m (BNM 3635).

Woodsia R. Br.

W. elongata Hook.; Nayar & Kaur. companion to Beddome: 9 (1974).

A frequent epiphyte on trees in Rambara forest, 2700 m (BNM 4761).

THELYPTERIDACEAE

Christella Leveillé

C. parasitica (Linn.) Lev.; Nayar & Kaur, companion to Beddome: 208 (1974).

Common near streams and water channels in Agustmuni forest, 700 m (BNM 3844).

Cyclogramma Tagawa

C. auriculata (J. Sm.) Ching; Nayar & Kaur, companion to Beddome: 71 (1974).

Commonly occurring on slopes amidst grass in Sonprayag—Gaurikund forests, 1800 m (BNM 4870).

Glaphyopteridopsis (H. Ito) Ching

G. erubescens (Wall. ex Hook.) Ching; Nayar & Kaur, companion to Beddome: 71 (1974).

A low altitude fern commonly occurring in *Quercus-Rhododendron* forests near Phata, 1500 m (BNM 5832).

Macrothelypteris (H. Ito) Ching

M. torresiana (Gaud.) Ching; Nayar & Kaur, companion to Beddome: 64 (1974).

A tall delicate fern, occasionally found at moist, shady places in Guptakashi forest, 1300 m (BNM 3665).

Phegopteris Fee

P. connectilis (Michx.) Watt.; Nayar & Kaur, companion to Beddome: 72 (1974).

Frequently distributed on slopes and semi-exposed areas of the forests near Rambara, 2700 m (BNM 4753, 4754).

Pseudocyclosorus Ching

P. ochthodes (Kze.) Holttum; Nayar & Kaur, companion to Beddome: 205 (1974).

A low altitude fern, frequently occurring at shady places in the forest of Sitapur, 1600 m (BNM 4919).

Pseudophegopteris Ching

P. aurita (Hook.) Ching; Nayar & Kaur, companion to Beddome: 91 (1974).

A common species in the forests of Gaurikund-Rambara, 2500 m (BNM 4764, 4765).

ASPLENIACEAE

Asplenium Linn.

A. indicum Sledge; Nayar & Kaur, companion to Beddome: 37 (1974).

A common epiphyte on *Rhododendron* trees in Guptakashi area, 1300 m (BNM 3629 b).

A. indicum Sledge var. *obtusum* Bir in Kachroo (ed.) Recent advances in Botany 113 (1976).

A rare epiphyte, occurring on *Rhododendron* trees in forests near Phata, 1500 m (BNM 4968, 5831).

A. varians Wall. ex Hook. et Grev.; Nayar & Kaur, companion to Beddome: 38 (1974).

Frequently occurring in Phata forests, 1500 m (BNM 4944).

POLYPODIACEAE

Arthromeris (Moore) J. Sm.

A. lehmanni (Mett.) Ching; Nayar & Kaur, companion to Beddome: 89 (1974).

Quite common on tree trunks at shady and moist places in Sonprayag-Gaurikund forests, 1800 m (BNM 4871).

A. wallichiana (Spr.) Ching; Nayar & Kaur, companion to Beddome: 89 (1974).

Common in rock crevices and on moss covered wet rocks in Sonprayag-Gaurikund forests, 1800 m (BNM 4866).

Grypsinus Presl

G. hastatus (Thunb.) Copel.; Nayar & Kaur, companion to Beddome: 87 (1974).

A very common epiphyte in Tolipani forests, 1800 m (BNM 4865).

Drynaria (Bory) J. Sm.

D. propinqua (Wall. ex Mett.) J. Sm.; Nayar & Kaur, companion to Beddome: 82 (1974).

A common epiphyte between 1300 to 1500 m altitude and 1600-1800 m in Sonprayag-Tolipani forests (BNM 3593, 2628, 4938).

Lepisorus (J. Sm.) Ching

L. clathratus (Clarke) Ching ; Nayar & Kaur, companion to Beddome: 85 (1974).

Commonly occurring on tree trunks in Rambara forests, 2700 m (BNM 4759). *L. kashyapii* (Mehra) Mehra in Bir, Res. Bull. Punjab Univ. (n. s.) 13 : 23 (1962).

Not common, occasionally met with on tree trunks in Gaurikund-Rambara forests, 2400 m (BNM 5487).

L. pseudonudus Ching ; Bir & Trikha in Bull. Bot. Surv. India 11 (3 & 4) : 268 (1969).

A common epiphyte on *Quercus-Rhododendron* trees in Gaurikund-Rambara forests. 2500 m (BNM 5487).

Laxogramme (Bl.) Presl

L. involuta (D. Don) Presl ; Nayar & Kaur, companion to Beddome: 94 (1974).

Occurring at low altitude (Phata, 1500m) on tree trunks and moss covered rocks and boulders (BNM 3999, 4937).

Polypodium Linn.

P. lachnopus Wall.; Nayar & Kaur, companion to Beddome: 78 (1974).

A very common epiphyte in Rambara forests, 2700 m (BNM 4760).

VITTARIACEAE

Vittaria Smith

V. flexuosa Fee; Nayar & Kaur, companion to Beddome: 96(1974).

Commonly found at low altitude, occurring on tree trunks in forests near Phata, 1500 m (BNM 4964).

COMMENTS

Ferns and fern allies constitute a major component of the rich vegetation of Mandakini valley. The intensity of fern species varies with the altitude and the largest number of ferns have been recorded between 1500—3000 m altitude. There is a marked decrease in the number of species above 3000 m altitude and only a few were encountered, notable among which are, *Athyrium atkinsoni*, *A. thelypteroides*, *Cryptogramma crispa*, *Dryopteris barbigera* and *Polystichum prescottianum*. The majority of the ferns are terrestrial in nature and the common species inhibiting the forest undergrowth and shady slopes are *Arthromeris lehmanni*, *Athyrium fimbriatum*, *Cyclogramma auriculata*, *Dryopteris sparsa*, *Glaphyopteridopsis erubescens*, *Nephrolepis cordifolia*, *Onychium contiguum*, *O. japonicum*, *Polystichum setiferum*, *Pseudophegopteris aurita*, *Pteris cretica* and *Tectaria cicutaria*. The thick coverage of Moss on the tree trunks of *Quercus-Rhododendron* with high humidity and moisture forms the most suitable hosts for epiphytic species. The common epiphytes are *Adiantum venustum*, *Asplenium indicum*, *Cheilanthes pteridioides*, *Crypsinus hastatus*, *Drynaria propinqua*, *Lepisorus clathratus*, *L. pseudonudus*, *Lycopodium setaceum*, *Polypodium lachnopus*, *Vittaria flexuosa* and *Woodisia elongata*. The lithophytic species are few and mostly found to grow on moss covered boulders, stones and in rock crevices. Notable among them are *Adiantum capillus-veneris*, *A. incisum*, *Arthromeris wallichiana*, *Cheilanthes farinosa*, *Lygodium flexuosum*, *L. japonicum*, *Polystichum stimulans*, *Selaginella involvens* and *S. subdiaphana*. The common species inhibiting the banks of streams and water channels are *Athyrium atkinsoni*, *Christella parasitica*, *Dipla-*

zium polypodioides, *Equisetum arvense* and *E. diffusum*.

Athyrium mackinsonii, *Cyrtomium caryotideum*, *Leucostegia delavayi*, *L. pseudostopteris* and *Microlepia strigosa* are some rare species collected from the Mandakini valley.

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