

PTERIDOPHYTES OF NEPAL: FAMILY- PTERIDACEAE

P. C. MISRA^{a1} AND SHRADDHA TIWARI^b

^aDepartment of Botany, H.N.B. Govt. P. G. College, Naini, Allahabad, U.P., India

^bDepartment of Botany, B.S. Mehta Degree College, Bharwari, Kausambi, U.P., India

ABSTRACT

This paper deals the family Pteridaceae of Nepal. Authors has collected two species of genus *Pteris* viz; *Pteris dactylina* Hook, *P. quadriaurita* (Retz.) and one species of *Coniogramme* viz; *Coniogramme intermedia* Hieron. Authors has studied their structural details, epidermal details like stomatal structures, frequency and sinuosity of upper and lower epidermis in great details. Spores sporangial and venation details are also studied in details.

KEYWORDS: Stomata, Epidermal Details, Frequency, Spores

The family Pteridaceae includes terrestrial fern of moderate size with erect, creeping or ascending rhizome clothed either by castaneous hairs or by basally attached gland tipped paleae. Fronds spirally arranged on the rhizome, stipe usually glossy, glabrous or scaly or hairy, purlish. Leaf various, but usually pinnately compound or often decompound and commonly with free veins but rarely having reticulate veins (aereols devoid of included veinlets). Fertile leaf similar to the sterile one or slightly reduced. Sporangia either spread over a special intra, marginal vein connecting the tips of the lateral veins and then protected by the scarious reflexed margin of the lamina or spread along all the lateral veins and then unprotected. Sporangia with a vertical annulus and long stalk. Spores bilateral or teraterahedral without perispore provided with skin like layer on the exine. exine rarely granulose.

MATERIALS AND METHODS

All the present are collected from Phoolchuki., Nepal. For the epidermal studies, pieces of young as well as mature pinnae were fixed in farmer's fluid (ethyl alcohol and acetic acid 3:1) and subsequently stored in the 70% ethyl alcohol. Epidermal peels were taken out by macerating pieces of pinnae in Schulz's fluid, using concentrated nitric acid and potassium chlorate and subsequently washing and treating with a dilute solution of ammonia (about 1%). Epidermal peels thus obtained were stained with saffranin and dehydrated through usual ethyl

alcohol series and subsequently mounted in euparal.

Venation and general orientation of stomata and epidermal cells were investigated in transparencies made by Foster's Technique (Foster, 1966). The pinnae were cleared in 2.5% aqueous sodium hydroxide solution followed by concentrated chloral hydrate, dehydrated in the usually alcohol series and stained in 1% solution of safranin in equal parts of xylene and absolute alcohol. Then mounted in euparal. Petiolar epidermis was studied in epidermal peels which were taken out often light maceration of petiolar pieces in conc. Nitric acid and potassium chlorate and subsequently treating with dilute aqueous ammonia solution. Epidermal peels thus obtained were also dehydrated in usual alcohol series and stained with 1% safranin in equal parts of xylene and absolute alcohol. Then mounted in euparal.

For spore studies, the procedure described by Nayar (1970) was followed. Observations were made under transmitted light microscope. Spore size was observed on the basis of the mean average calculated from a minimum twenty five readings in each plane of spores and was exclusive of the perine.

The nature of various depositions and cell substances was detected by special histochemical tests performed. Presence of lignin was confirmed by occurrence of red colour after treating the lignified portions with phloroglucinal followed by a drop of 25% hydrochloric acid. Phloroglucinal solution was made by dissolving 1 gm phloroglucinol in 100 ml of 94% ethanol.

¹Corresponding author

RESULTS AND DISCUSSION

Coniogramme intermedia Hieron

(Text fig.-9 A-C, Plates- 18A-F, 61D, 74A-D).

Terrestrial fern, rhizome is short, creeping. Stipe is erect, polished, pale yellow in colour, grooved. Fronds large, simply pinnate. Pinnules is 10-14 cm. long and 2-3 cm. broad. Pinnae are large, may be more or less equal to the stipe in length, finely dentate. Pinnae are arranged sub-opposite to alternate, sub-sessile. Sori arranged along the veins but they leave 1/3 length before reaching to the margin. Sporangium contains 12-14 annulus cells. Spores are more or less triangular in shape with trilete mark. Exine ornamentation granulose or psilate. Spore size is 42 µm X 35µm.

Venation pattern is open dichotomous type. Side veins originate from the midvein. Side veins are usually bifurcated once or twice. On lower side of pinnae side veins bifurcated twice as compared to once but on upper side or middle they bifurcated only once. Pinnules are hypostomatic i.e. stomata are present only on the abaxial side. Stomata are eupolo-mesoperigenous type. But some are simple and surrounded by 2-4 neighbouring cells also. Both the sides have sinuous walled cells. The vein area cells are elongated and very less sinuous as compared to others. The amplitude of sinuosity and wavelength of sinuosity of lower epidermal cell is 27µm and 105µm respectively while the amplitude of sinuosity and wavelength of sinuosity of upper epidermal cell is 30 µm and 157 µm respectively.

The species of *Coniogramme* has been distributed in Himalaya, China, Indo-China, Korea, Formosa, Japan. and Collected from Phulchoki of Nepal. As far as author knows only five species of *Coniogramme* have been reported so far from Nepal. These are *Coniogramme affinis* (Wall.) Hieron., *C. caudata* (Wall. ex Ettingsch) Ching., *C. fraxinea* (D.Don), *C. intermedia* Hieron., *C. procera* (Wall.) Fee.(see Sinha and Gurung 1985, Gurung 1997). Devi (1988) described the spores of it and placed it in Pteridaceae.. In the present study, the author has collected and studied only one species in details i.e. *Coniogramme intermedia* Hieron. The arrangement of sporangia is very peculiar. It is run along the veins up to 2/3 of the pinnulus.

Pteris dactylina Hook

(Text fig-33A-D, Plates-6A-B, 51A-F, 52A-F, 66D, 74E-H).

Rhizome long, creeping, thin, frond up to 30cm long, narrow, pinnate, usually one pair of lateral pinnae and a terminal one. Rhizome is clothed with scales. Scales are long, narrow, broad at base and narrow at the tip, cells of the scales are irregular but elongated in shape. Fertile and sterile leaves are almost equal in shape. Fertile leaves had sori on their margin but not up to the tip. Mid veins are very prominent. Sporangia have 18-20 cells in annulus. Spores are triangular with trilete mark. Spores are 42µm X 39µm in size. Outer ornamentation is rugulate. Spores are provided with a collar like exinous ridge and devoid of any distinct perine but having on outer skin like layer on the exine.

Veins are dichotomously branched and with open type of venation. Side veins originate from the main vein. Mid vein is always quite thick than the side veins. Side veins are bifurcated. Both the upper and lower epidermal cells are sinuous walled. Lower epidermal cells have stomata so the leaves are hypostomatic. Stomata are surrounded by 2 to 4 cells. Vein area cells are elongated in shape. The amplitude of sinuosity of upper epidermal cells is 37µm and the wavelength of sinuosity is 245µm but the amplitude of sinuosity and the wavelength of sinuosity of lower epidermal cells are 30 µm and 126 µm respectively.

Pteris quadriaurita (Retz.)

(Text fig-34A-D, Plates-2B, 50A-F, 53A-F, 65C-D, 78E-H).

PCM Collection no.-12166-12170.

Terrestrial fern. Plant is 30-40 cm long and 10-30 cm broad. Rhizome short, erect, woody. Stipe erect, 10-20 cm long, fronds large 10-15 cm long, 2-5 cm broad, lanceolate or ovate, variable in size, cut down nearly to the rachis into many uniform segments, veins more prominent on abaxial side and side veins originate from the mid vein. Side veins are once forked only. Sori are arranged on the margin of the pinnules like a border line but not at the tip of the pinnules. Spores trilete, provided with an collar like exinous ridge and devoid of any distinct perine but having

on outer sporoderm like layer on the exine. Spore is 38 X 40 μm in size, annulus of sporangia are 16-18 celled. Outer ornamentation is verrucate and sometimes regulate.

Venation is open dichotomous type. The last side vein of pinnules appear about to touch the side vein of other pinnules. Side veins originating from the main vein are once forked. Both the upper and lower epidermal cells are sinuous walled. Stomata are surrounded by 2-4 neighbouring cells. The vein area cells are elongated and sinuous walled. The amplitude of sinuosity of upper epidermal cells is 38 μm and the wavelength of sinuosity is 121 μm . The amplitude and wavelength of sinuosity of lower epidermal cells are 39 μm and 113 μm respectively. Cells of both upper and lower epidermal cells are elongated i.e. length of the cells are larger than the width of the cells.

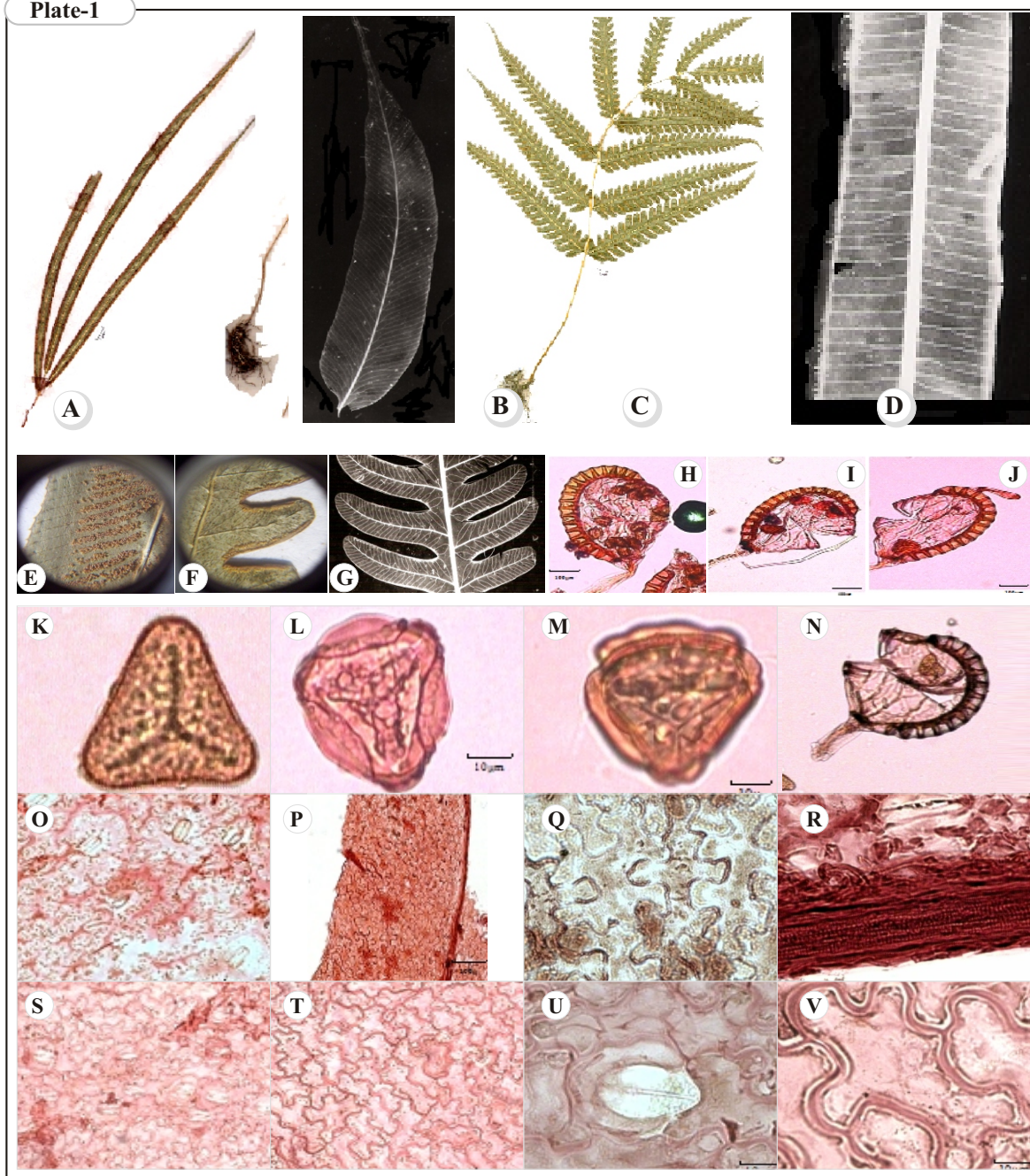
The species of *Pteris* has been distributed in Eastern Himalayas, N. Burma, N. Thailand, Yunan and collected from Phulchoki in Nepal. Nearly ten species of *Pteris* have been reported so far in Flora of Nepal. These include *Pteris vittata*, *P. cretica*, *P. pellucida*, *P. dactylina*, *P. quadriaurita*, *P. excelsa*, *P. wallichina*, *P. biaurita*, *P. aspericaulis*, *P. geminate*. However Sinha and Gurung 1985 mentioned only seven species viz. *Pteris vittata*, *P.*

dactylina, *P. quadriaurita*, *P. excelsa*, *P. wallichina*, *P. geminate*, *P. subquinta*. In the present study, the author collected and studied only two species viz. *Pteris dactylina*, *P. quadriaurita*. respectively in details both the species are different in their morphology and in other internal structures. *P. quadriaurita* has papery pinnules and their veins are typically dichotomous open type while in *P. dactylina* the pinnules are long and narrow. Both the plants have triangular and trilete marked spores and their ornamentation is regulate. They are different in shape and size.

ACKNOWLEDGEMENT

We express our deep sense of gratitude to the respective Late Dr. R.D.Dixit from B.S.I. Allahabad and Late Prof. P.K.Khare from university of Allahabad, Allahabad, for helping us in identification of species. We are greatful to Prof. D. R. Misra, university of Allahabad, Allahabad, who has given me support at every steps.

Plate-1



- | | | | |
|----|---|----|---|
| A. | Photographs of plant <i>Pteris decetylina</i> . | H. | Sporangia of plant <i>Pteris decetylina</i> |
| B. | Venation pattern of plant <i>Coniogramme intermedia</i> | I. | Sporangia of plant <i>Pteris quadriaurita</i> |
| C. | Photographs of plant <i>Pteris quadriaurita</i> | J. | Sporangia of plant <i>Pteris quadriaurita</i> |
| D. | Venation pattern of plant <i>Pteris decetylina</i> | K. | Spore of <i>Coniogramme intermedia</i> |
| E. | Pinnules of <i>Coniogramme intermedia</i> showing sporangial attachment | L. | Spore of <i>Pteris quadriaurita</i> |
| F. | Pinnules of <i>Pteris quadriaurita</i> showing sporangial attachment | M. | Spore of <i>Pteris decetylina</i> |
| G. | Venation pattern of plant <i>Pteris quadriaurita</i> | N. | Sporangia of plant <i>Coniogramme intermedia</i> |
| | | O. | Lower epidermal cells with stomata of <i>Pteris quadriaurita</i> X 10 |

- P. Upper epidermal cells without stomata of *Pteris quadriaurita* X 10
 Q. Upper epidermal cells without stomata of *Pteris quadriaurita* X 40
 R. Lower epidermal cells of vein area with stomata of *Pteris quadriaurita* X 40
 S. Lower epidermal cells with stomata of *Pteris decylyna* X 10
 T. Upper epidermal cells without stomata of *Pteris decylyna* X 10
 U. Lower epidermal cells with stomata of *Pteris decylyna* X 40
 V. Upper epidermal cells without stomata of *Pteris decylyna* X 40

Plate-2

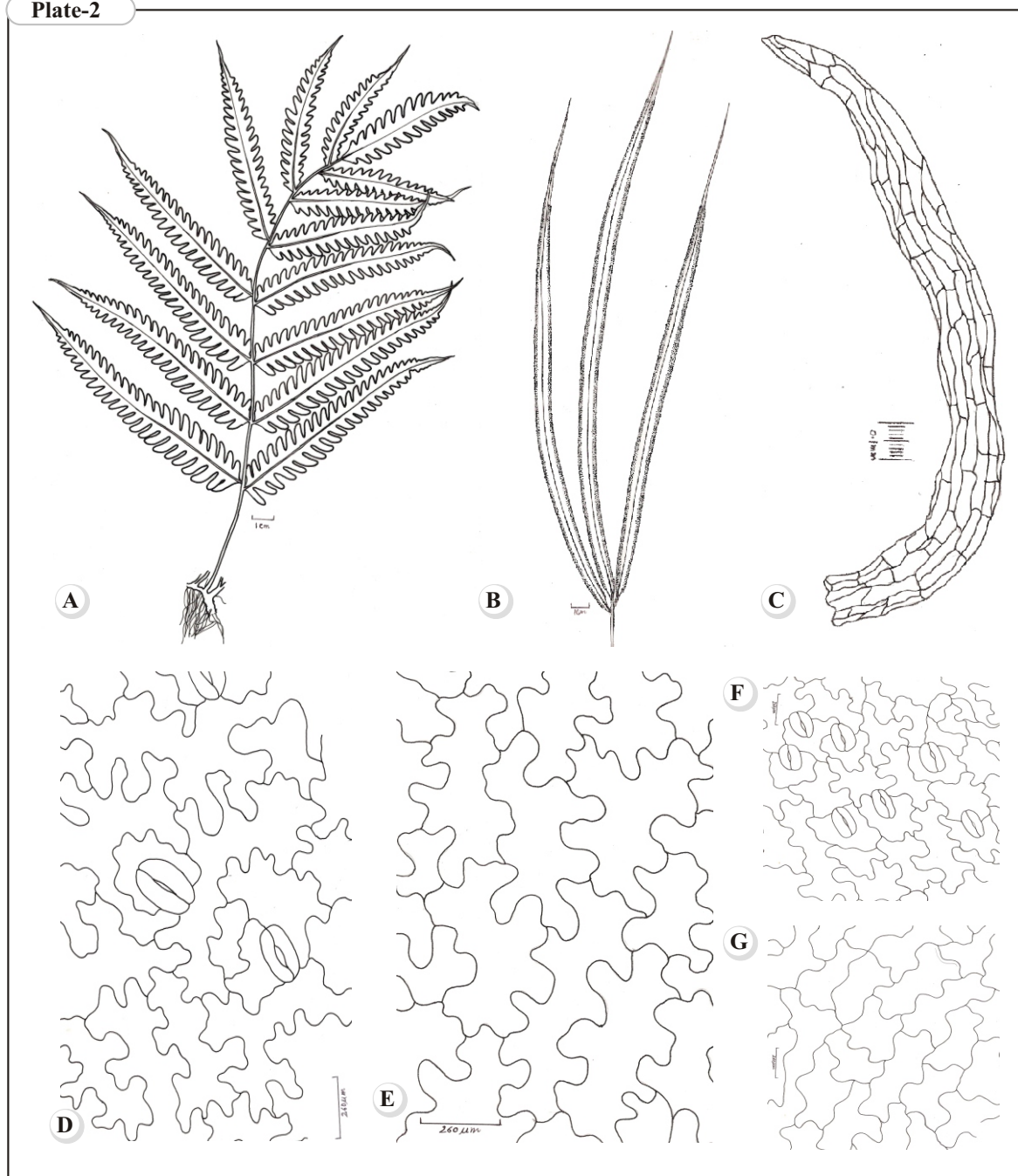


Plate 2 :

- A. Drawing of plant *Pteris quadriaurita*
- B. Drawing of plant *Pteris dectylina*
- C. Scale of plant *Pteris dectylina*
- D. Drawing of lower epidermal cells of plant *Pteris quadriaurita*
- E. Drawing of upper epidermal cells of plant *Pteris quadriaurita*
- F. Drawing of lower epidermal cells of plant *Pteris dectylina*
- G. Drawing of upper epidermal cells of plant *Pteris dectylina*

REFERENCES

- DEVI, S., 1988. Spores of pteridophytes. Indian Fern J. **5**:28-57.
- Foster A. S., 1966. Morphology of anastomoses in the dichotomous venation of *Circaeaster*. Am.J.Bot. **53**: 588-599.
- Gurung V. L., 1995. Role of ferns in protection of the environment. Proc of Second Bot Conf Nepal. 119-128.
- GURUNG, V. L. 1997. Primitive and Advance Characters in Some Ferns from Nepal. Bionature **17**(1): 13-23.
- Nayar B. K., 1970. A Phylogenetic classification of homosporous ferns. Taxon **19**: 229-236.
- Sinha B. M. B. & Gurung V. L., 1985. Phytogeographical Distribution of Pteridophyte Flora of Nepal Himalaya in Relation to Central Nepal. Indian Fern Jour. **2**: 17-21.