(III)

STUDIES ON SPORE MORPHOLOGY OF *ADIANTUM* L. FROM TEHRI DISTRICT OF UTTARAKHAND

Introduction

Adiantum L. popularly known as 'Maiden hair fern' is widely distributed genus of about 200 species. Many species of *Adiantum* are in use from time immemorial for their alleged medicinal properties (Nayar, 1961). It is probably one of the most popular of all ferns due to its wide distribution, medicinal uses and ornamental foliage. *Adiantos* means dry that is water does not rest on the foliage. The generic name *Adiantum* is of Greek origin and means unwetted, referring to the rain shedding texture of the foliage in many species cf. (Proctor, 1985 vide Vasudeva *et al.*, 1991). The genus *Adiantum* comprises of 25 species in India (Dixit, 1984). Ecologically *Adiantum* is an occupant of moist shaded rocks and several species also frequently grow terrestrially in clay or humus rich soil.

The spore of pteridophytes serves as store house of genetic information. The pteridophytic spores remain protected by an efficient envelope against environmental condition. The outer envelope also makes a strong base for the understanding of evolution. Morphological studies serve in the identification of viable particles as air pollutants, many of which manifest allergic reactions in human being or propagate plants and animal diseases. Spore system presents a unique basis as test systems for evolution of toxicity of pollutants, especially mutagens and carcinogens. A historical account of study of spores was given by Devi (1977). For long time, the interests in spore's studies were confined to their taxonomical implication. Alston (1956) has used the character of spores for the scheme of classification. Knox (1938) has initiated study of spore to contribute to the fossil studies. Bir (1976) has attempted the interpretation of phylogeny and classification of different families making spore morphology as an important character.

Despite the interest in the fern cytology, anatomy and morphotaxonomy of the Indian pteridophytes, there is not much known about the spores of *Adiantum* from the Himalayas (Panigrahi and Dixit, 1968). This paper is the first attempt on the spore structure of the 6 Species of genus *Adiantum* from Tehri district, Uttarakhand. The spore were collected from the specimens brought from the Tehri area and preserved in the Herbarium of Botanical Survey of India,(NRC) Dehra Dun.

Material and Methods

Light microscope observations (Olympus CX41) of spores were made from the spores collected from fresh material and herbarium specimens. The specimens were collected during the year 2009-2011 from Tehri district. The spore size recorded was the mean average calculated from minimum of 10 reading in each plane of spore. For the measurement of the spore size Analysis Image Processing software, provided by Olympus, was used.

Observations

Fern spores are basically found in two forms; tetrahedral - trilete and bilateral - monolete. The position of the laetus in the spore is determined by the mode of attachment of the sister spores in the tetrad stage. Tetrahedral spores are characteristically present in Adiantaceae. Some fern families possess both bilateral as well as tetrahedral form of spores. Though the spore form is a stable character in a particular taxon but there are reports of change from trilete to monolete (Devi, 1974). The family Adiantaceae has spore with equatorial collar separating distinct proximal and distal faces. Nayar and Devi (1968) have discussed the affinities of *Adiantum* L. on spore-morphological grounds and have concluded that "*Adiantum* L. is an isolated genus which form the point of view of spore morphology is comparatively primitive". All the species of *Adiantum* from the area has smooth granulose or verrucose perispore folds (Fig. 1). Detailed description of the spores of each species is given below:

Adiantum capillus-veneris L., Sp. Pl. **2**:1096, 1753. Spores dark-brown, tetrahedral, trilete, 51-52 X 45 X 47 μm, non perinate, triangular, exine smooth, thin.

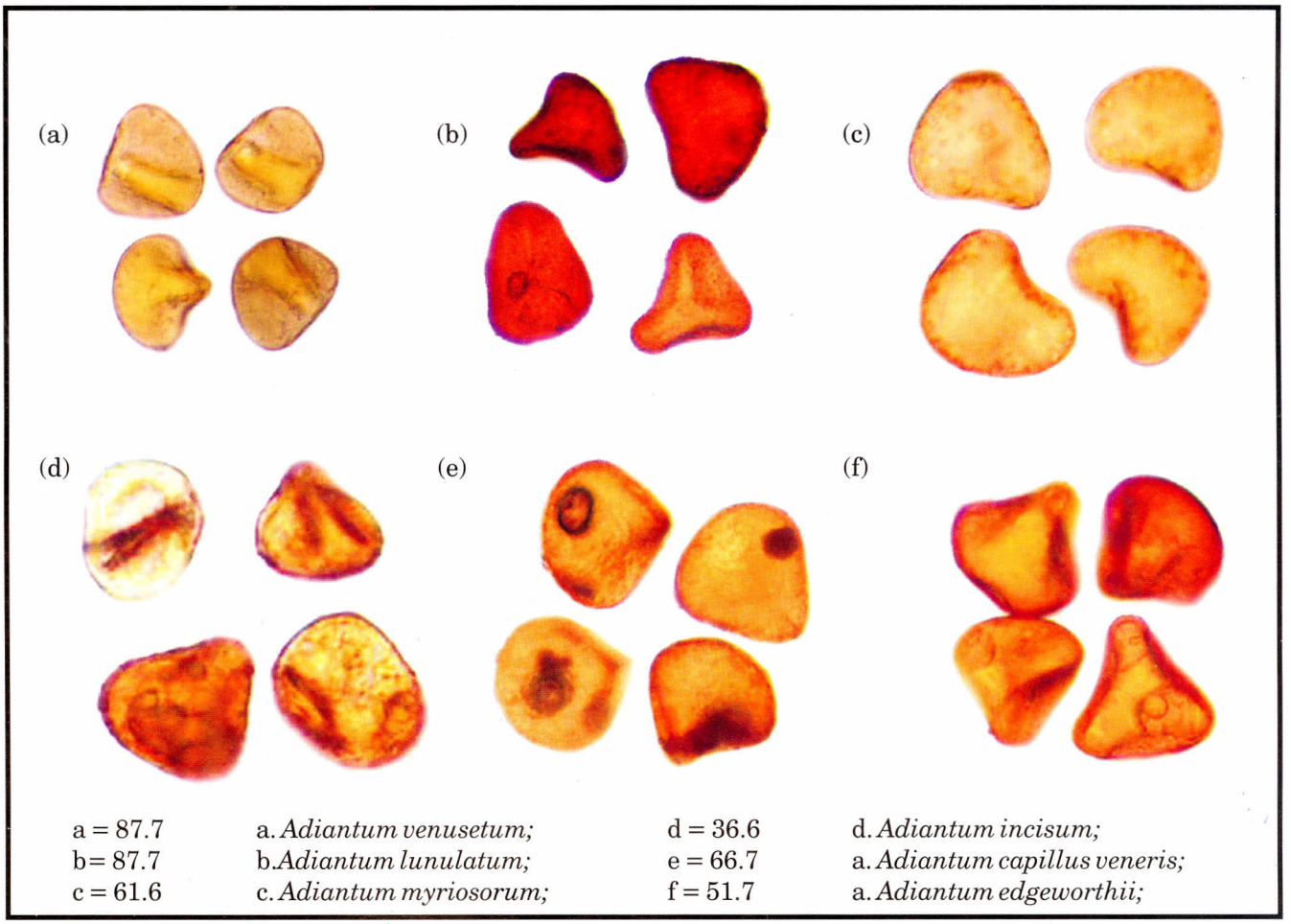
Adiantum edgeworthii Hook., Sp. Fil. **2**:14, t.81(b), 1851. Spores tetrahedral, triradiate, 29-32 X 27-28 μm, non perinate, exine smooth, brown coloured.

Adiantum incisum Forsk., Fl. Acg. Ar.187, 1775. Spores tetrahedral, trilete, 20-26 X 27-28 μm, non perinate, exine smooth, brownish yellow.

Adiantum lunulatum Burm., Fl. Ind. 235,1768. Spores brown, tetrahedral, trilete, 47-58 X 37-41μm, non perinate exine smooth, thin.

Adiantum myriosorum Bak. Kew Bull. Misc. Inf. 1898:30, 1898. Spores pale-yellow, tetrahedral trilete,

Fig. 1



a = 87.7	a. *Adiantum venusetum;*	d = 36.6	d. *Adiantum incisum;*
b= 87.7	b.*Adiantum lunulatum;*	e = 66.7	a. *Adiantum capillus veneris;*
c = 61.6	c. *Adiantum myriosorum;*	f = 51.7	a. *Adiantum edgeworthii;*

Adiantum species having smooth granulose or verrucose perispore folds.

30-40 X 29-32 μm, non perinate, exine thin, faintly granular or smooth.

Adiantum venusetum D. Don, Prod. Flora Nepal.17, 1825. Spores light brown, tetrahedral, triradiate, 41-43 X 37-38 μm, non perisporiate, exine smooth.

The applications of fern spore in oil palynology and stratigraphy are well known. Spores are used to trace the strata holding oil as well as other valuable minerals. They are also used by the archaeologists to date the relics of past civilization, after indexing the spore types. The medical application of palynology is very important and is being followed by many workers. The minute size of the spore and highly chemically resistant spore walls enable them to be ideal fossil index for correlations (c.f. Devi, 1988).

Pteridophytes are associated to ecosystems that are particularly sensitive to degradation, some of which are considered natural habitat of high priority. Pteridophytes are very sensitive to environmental changes so palynological studies and their inclusion in spore germplasm bank is essential.

Acknowledgements

The authors are grateful to The Director, Botanical Survey of India, Kolkata, and Scientist incharge, BSI (NRC), Dehradun for providing facilities to work. Authors are also thankful to the Head, Department of Botany, Kumaon University Campus, Almora, for encouragements.

References

Alston, A.H.G. (1956). The subdivision of polypodiaceous ferns. *Taxon,* **5**: 23-25.

Bir, S.S. (1976). Contribution of the spore morphology in the taxonomy of some taxa of ferns. *Advances in Pollen Spore Researches*, **2** :92-119. Today and Tomorrow's Printer and Publishers. N. Delhi, India.

Devi, S. (1974). On occurence of bilateral spores on cultivated *Pteris longifolia. Grana,* **14**:1-13

Devi, S. (1977). Spores of Indian ferns. Today and Tomorrow's Printer and Publishers. N. Delhi, India.

Devi, S. (1988). Spores of Pteridophytes. *Indian Fern J.*, **5**:28-57.

Dixit, R. D. (1984). A Census Indian Pteridophytes, Flora of India - IV. *Bull. Bot. Surv. India,* Howrah. i-iii, 1-177, Deep Printers, N. Delhi.

Knox, E.M. (1938). The spores of pteridophyta with observation on microspores in coal of carboniferous age. *Trans. Proc. Bot. Soc.* Edinb., **32**, 438-466.

Nayar, B.K. (1961). Ferns of India 1. *Adiantum* L. *Bull. Natl. Bot. Gards, Lucknow*, **52**, 1-40.

Nayar, B.K. and S. Devi (1968). Spore morphology of the Pteridaceae IV. Taxonomy and phyletic considerations. *Grana Palynol.*, **8**,517-535.

Panigrahi, G. and R. D. Dixit (1968). Studies in systematics of Indian *Selaginella*-1. *Proc. Nat. Insti. Sci.*, India B 34 **(4)**:191-209.f.1-12.

Proctor, G.R. (1985). Ferns of Jamaica British, Museum (Nat. Hist.). Crowmwell Road London, SW75BD.

Vasudeva, S.M. Anoopjit Kaur and Kulwinder Kaur (1991). Taxonomic revision of *Adiantum* L. species of India. *Indian Fern J.*, **8**: 161-179.

H.C. Pande, Pushpesh Joshi, Brijesh Kumar
and Himanshu Dwivedi

Botanical Survey of India,
Northern Regional Centre
Dehradun (Uttarakhand)