Indian J.L.Sci. 4 (2) : 91-95, 2015

ISSN : 2277-1743 (Print)
ISSN : 2278-7879 (Online)

AIR POLLUTION AND THE SENSITIVITY OF STOMATA IN PTERIDOPHYTES

SHRADDHA TIWARI[1]

B. S. Mehta Degree College, Bharwari, Kausambi, Allahabad, Uttar Pradesh, India

ABSTRACT

The paper describe for the first time an illustrated account of comparision of effect of air pollution with help of pteridophytic plants. A total of five genus of various pteridophytes has been enumerated so far. There epidermal details like stomatal structure, frequency and sinuosity of upper and lower epidermis has been discussed in great details.

KEYWORDS : Stomata, Air Pollution, Epidermal Details, Pteridophytes.

District Sonebhadra is recently upgraded from the stature of Nagar Panchayat in the Indian state of Uttar Pradesh. District Sonebhadra is a second largest district of U.P.,in India. It is situated between 24.42°N Latitude and 82.98°E Longitude. It has an average elevation of 170 metres (557 feet). District Sonebhadra has a very important role in revenue of state also and it is only because of mining and some very important industries also. And that is the reason why environmental pollution is increasing day by day.

Pteridophytes in general and ferns more particularly have attracted a great deal of attraction of botanists from all over the world due to their occupying a pivotal central position in world of higher plants. In hierarchy of evolution, Pteridophytes came perhaps placed next to the bryophytes and early to the gymnosperms. Thus they are occupying a central position. They are perhaps the first bonafide vascular plants. In the early geological history, between bryophytes and gymnosperm, they came roughly in Mid or Upper Silurian period nearly 420 million years ago. Pteridophytes are also regarded as the most interesting and fascinating group of higher plants. They are also termed sometimes as higher vascular cryptogams or early vascular plants. These plants are comprised of well developed sporophyte generation and sporophyte is well developed in having conducting vascular strands made up of chiefly xylem and phloem tissues. However, there are some exceptional pteridophytes which lack the true thickenings in their xylem strands and such plants are often called as quasipteridophytes and such intermediate plants are bridging between the real pteridophytes and bryophytes.

The aim of this study was to evaluate the effect of stone crushing industry and other pollution activities on different pteridophytic plants of the forest concerned (Ashenden, 1978 and 1979.). Measurement of suspended particulate matter (SPM), dustfall and gaseous pollutants in ambient air were done. Heavy deposition of dust particles on leaf surfaces was noted. Various types of foliar anomalies, both microscopic and macroscopic, were detected externally. Changes in the epidermal structures and details were also noted. Sitewise and seasonwise variations of almost all data were found to be statistically significant. Comparison of air pollution status and epidermal parameters are recorded along with study of spatial significance between polluted sites at obra and its adjoining areas with increasing distance from the source of pollution. A significant correlation was established in many cases between epidermal parameters and air pollutants present in ambient air in the highly polluted site of the forest close to the source of pollution.

MATERIALS AND METHODS

The material of diverse pteridophytes is collected from different localities of Markundi, Chopan, Obra and Renukoot of district Sonebhadra. The plants are- *Adiantum capillus - veneris* L. (Figure 4), *Dryopteris sparsa* (Don) Kuntze. (Figure 2), *Equisetum diffusum* D. Don. (Figure 1), *Marsilea minuta* L. (Figure 3), *Selaginella chrysocaulos* (Hook et Grev.) Spring. The collected specimens were dried and treated with mercuric chloride. The specimens were duly numbered. For the identification help has been taken from BSI (Central circle Allahabad) and from Duthie Herbarium of Botany Department, University of Allahabad. For the study of cuticle, stomata and epidermal details,

[1]**Corresponding author**

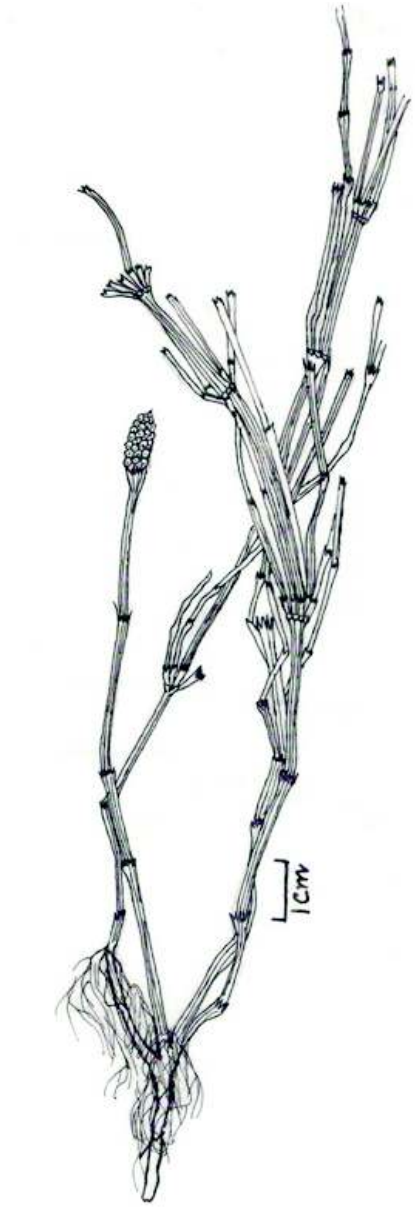

Figure 1 : Diagram of *Equisetum diffusum* D.Don.

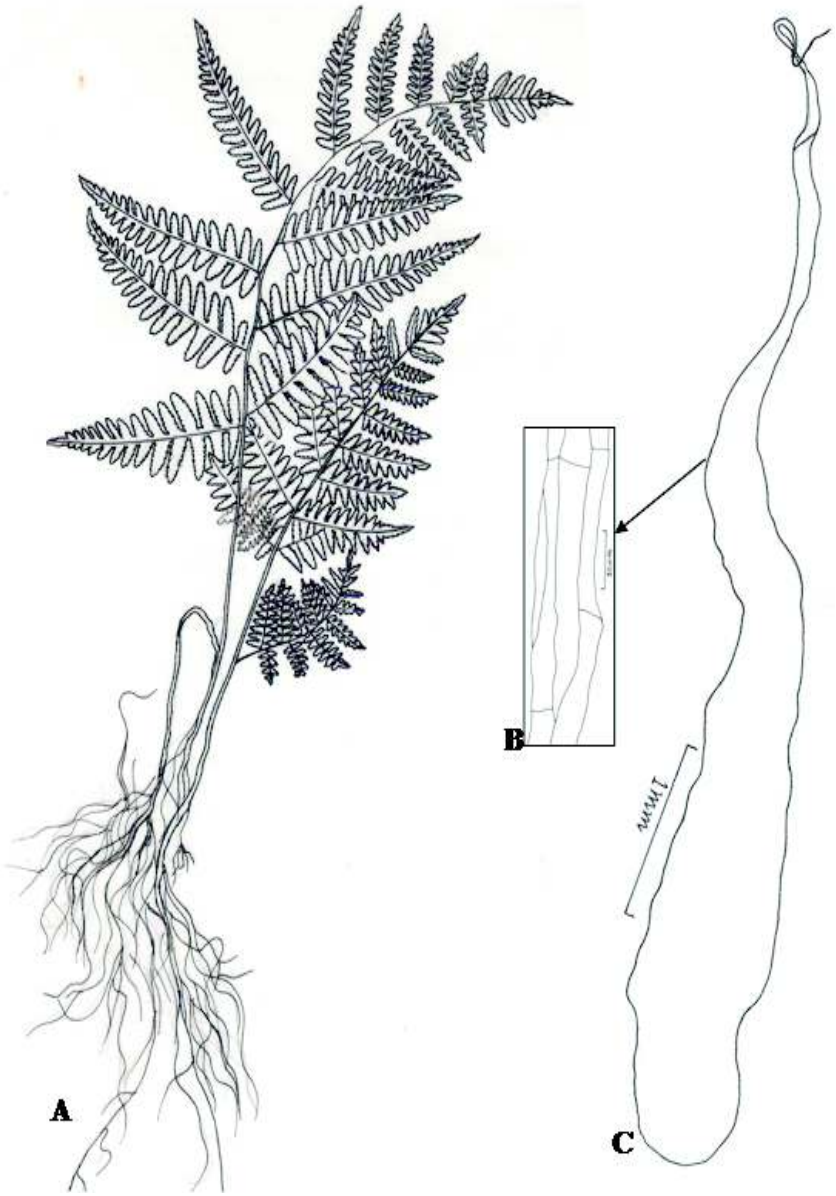

Figure 2 : Diagram of *Dryopteris sparsa* (Don) Kuntze.

small pieces of mature pinnules were fixed in FAA. The usual technique employed by Pant school, has been employed. Epidermal peels were taken out by treating the material with Shulze's techniques of maceration. Venation pattern has been studied by making preparations of transparency using Foster's technique (Foster, 1966). Lastly it is mounted in euparol.

After formation of stomatal slides and transparencies, the no. of stomata, frequency of stomata, sinuosity of epidermal cells and depositions were studied with the help of high resolution microscopes with grid systems. All these specimen are compared with the specimen of Nepal localities (Bir et al. 1991; Gurung, 1984, 1986).

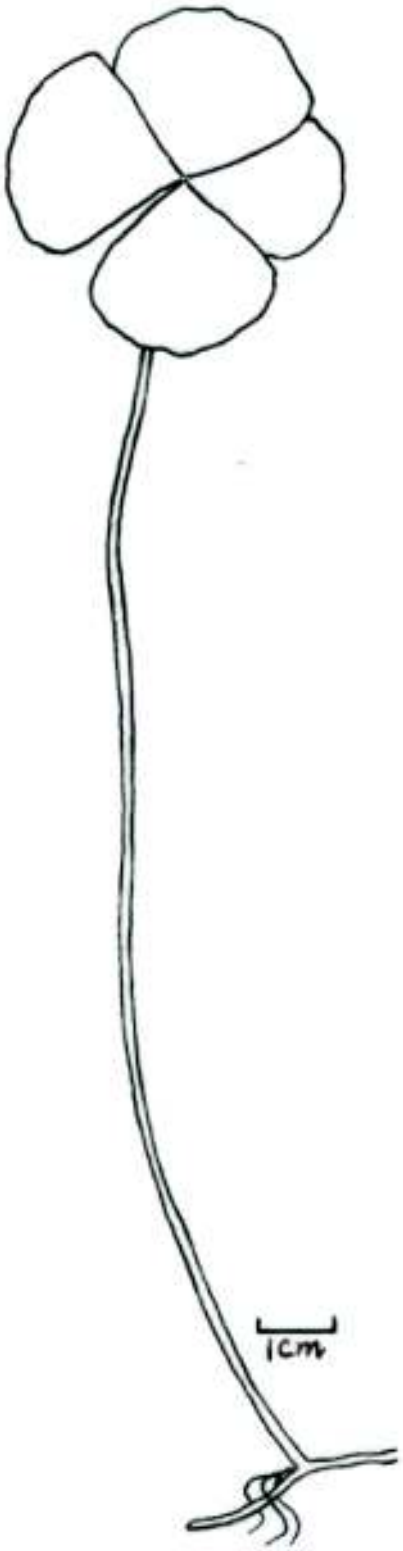

Figure 3 : Diagram of *Marsilea minuta* L.

Figure 4 : Diagram of *Adiantum capillus - veneris* L.

RESULTS AND DISCUSSION

All these five species has been studied and microscopic examination of peeled leaf surface from polluted sites revealed that stomatal apertures were heavily blocked by dust particles (Baier and Hahtung, 1988), a fact that could directly affect respiration, photosynthesis (Williams and Banerjee, 1995) and transpiration, and could indirectly affect ascent of sap in plants (Darrall, 1989 and Farmer, 2002). Although apparently visible leaf injury symptoms are many, the portions of leaf surface having no such apparent symptoms were examined under high resolution. Some important findings noted are: (a) Damage of cuticle and epicuticular structure, (b) sinuosity of epidermal cells are reduced, (Plates- 1 to 8)(c)Damage of oil glands, (d) Damage of guard cells, (e) Reduction in stomatal

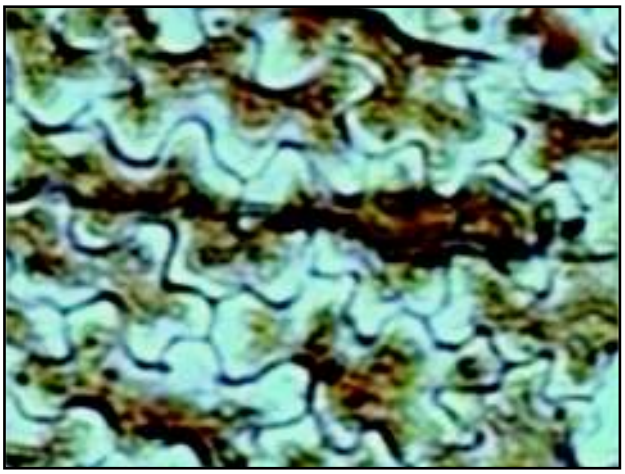

Plate 1 : Photograph of Lower Epidermis of *Adiantum capillus - veneris* L. Showing Sinuosity

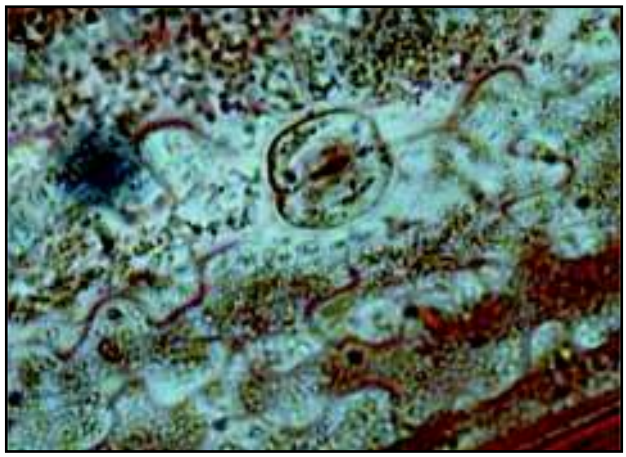

Plate 2 : Photograph of Lower Epidermis of *Adiantum capillus - veneris* L. Showing Less Sinuosity With Embedded Particles (Polluted Plant)

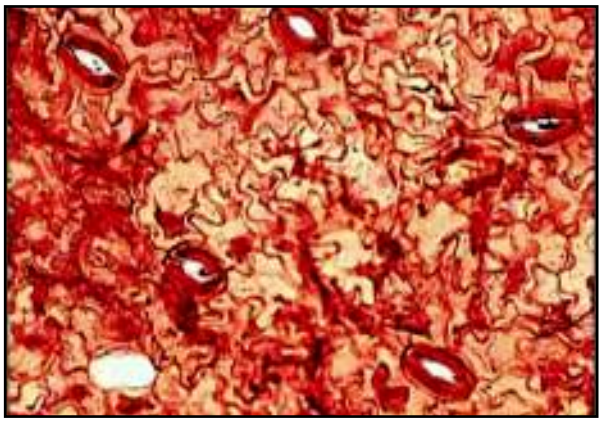

Plate 3 : Photograph of Lower Epidermis of *Marsilea minuta* L. Showing Sinuosity

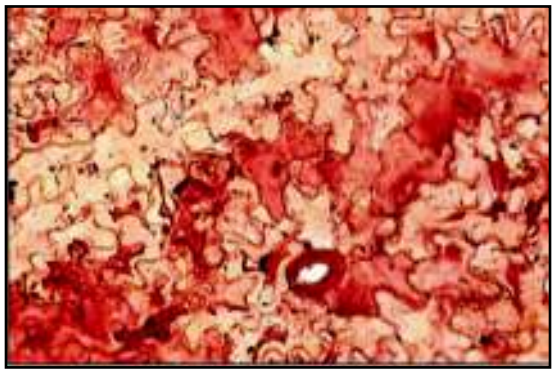

Plate 4 : Photograph of Lower Epidermis of *Marsilea minuta* L. Showing Less Sinuosity With Embedded Particles (Polluted Plant)

Plate 5 : Photograph of Lower Epidermis of *Dryopteris sparsa* (Don) Kuntze. Showing Sinuosity

Plate 6 : Photograph of Lower Epidermis of *Dryopteris sparsa* (Don) Kuntze. Showing Less Sinuosity With Embedded Particles (Polluted Plant)

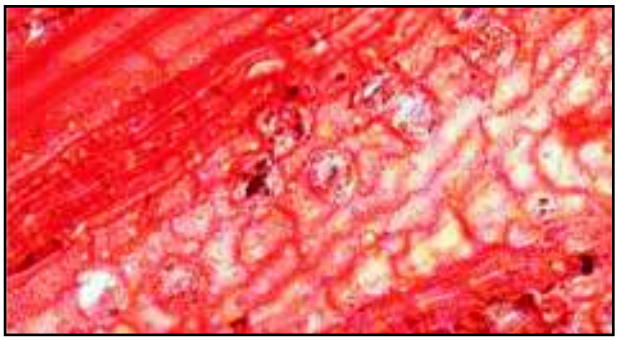

Plate 7 : Photograph of Lower Epidermis of *Equisetum diffusum* D. Don. Showing Sinuosity

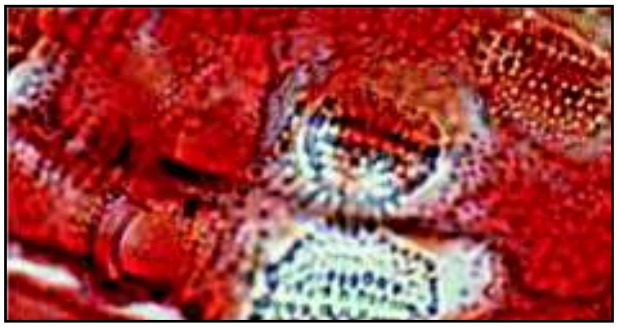

Plate 8 : Photograph of Lower Epidermis of *Equisetum diffusum* D. Don. Showing Less Sinuosity With Embedded Particles (Polluted Plant)

size and number and (f) Thick embedding of stone dust on surface (even after thorough and repeated washing) (Prajapati and Tripathi, 2008).

ACKNOWLEDGEMENTS

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 grateful to Prof.D.R.Misra, University of Allahabad who has given me support at every step.

REFERENCES

Ashenden T. W., 1979. Effects of SO_2 and NO, Pollution on transpiration in *Phaseolus julgaris* L. Environmental Pollution, **18** : 45-50.

Ashenden T . W. and Mansield T . A., 1978. Extreme pollution sensitivity of grasses when SO_2 and NO_2arc present in the atmosphere together. Nature (London), **273** : 142-143.

Baier M. and Hahtung W., 1988. Movement of abscisic acid across the plasmalemma and tonoplast of guard cells of *Vaierianella locusta*, *Botanica Acta*, **101**:332-337

Bir S. S., Vasudeva S. M., Kachroo P. and Singh Y., 1991. Pteridophytic flora of North Eastern India-V. Ecological, Distributional and Phytogeographical account. Indian Fern J., **8**: 98-139.

Darrall N. M., 1989. The effect of air pollutants on physiological processes in plants. Plant, Cell and Environment, **12** : 130.

Farmer A., 2002. Effects of particulates. In: Bell, J. N. B., Treshow M., Air pollution and plant life, John Wiley and Sons Ltd., 2nd Edition.

Gurung V. L., 1984. Ferns of Nepal. Nature's Paradise, 194-211.

Gurung V. L., 1986a. Flora of Kathmandu Valley. Bull. Dept. Med. Pl. Nepal, **11** : 1-111.

Prajapati S. K. and Tripathi B. D., 2008. Seasonal variation of leaf dust accumulation and pigment content in plant species exposed to urban particulates pollution. Journal of Environmental Quality, **37** : 865-870

Williams A. J., Banerjee S. K., 1995. Effect of thermal power plant emission on the metabolic activities of *Mangifera indica* and *Shorea robusta*. Environment and Ecology, **13**:914-919.