Research Paper Botany

Auto-Exhaust Pollution Induced Changes in Micromorphology of *Withania somnifera*

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ABSTRACT *The present paper deals with the study of micromorphology of Withania somnifera leaf. The light microscopic study of this plant indicate sharp alternation in the epidermal traits, with decreased number of stomata & epidermal cells & contrary to this increased dimensions of stomata (length/breadth of guard cells).The results indicate that plants has developed some adaptation or changes to survive under stressed conditions of auto-exhaust pollution & these changes could be consider as indicators of environmental stress.*

KEYWORDS : Micromorphology, Stomata, Sites, Auto-exhaust

INTRODUCTION

The mad race among the nations over the globe for the development jeopardised the health of man himself and progress in agriculture, transportation and industry is taken as general criterion of the development of any country. This craze resulted into unlimited exploitation of every bit of natural resources. In last few decades, there has been a sharp increase in the air pollution all over the world. There is many fold increase in the number of automobiles in Indian cities. Petrol and diesel driven motor vehicle emit pollutant like- benzene, CO, oxides of nitrogen, sulphur dioxide, suspended particulate matter, organic compound, smoke, metals(Cd ,Co ,Cu, Pb, etc.) and dust. The ultra fine particles when released, quickly coagulate into large particles though reaction with other pollutants like sulphure dioxide, nitrogen oxides, ammonia and volatile organic compounds(Street et al. 1996). Plants are sink for air pollution (Gajghate and Hassan 1999). Plant species differ in their ability to mitigate traffic pollution due to difference in their leaf surface characters such as epidermis, stomata, trichomes, wax, cuticle (Neinhuis and Barthlott,1998). The plants growing under the stressed conditions of pollution develop different physiological, anatomical, morphological changes (Inamder and chaudhari 1984, Iqbal 1985, Gupta and Ghose 1988, Gravano et al. 2003, Dineva 2004). Several studies has been carried in India to highlight the impact of air pollution on the micromorphology of different plants (Palaniswamy et at. 1995, Morison 1998, Kaur 2004).

Automobiles are one of the main source of air pollution in city Ghaziabad. Ghaziabad is an important industrial District of Western Uttar Pradesh comes under National Capital Region (NCR). Ghaziabad border is the route through which traffic from Delhi enters in U.P. and National Highway No. 2 (to Hapur), 91 (to Bulandshahr), and 58 (to Meerut) passes through city Ghaziabad. Present study was conducted in city Ghaziabad.

MATERIALS & METHODS

For present study three sites were selected in city Ghaziabad i.e. Highly Polluted Area(HPA), Medium Polluted Area(MPA), Fresh Area (FA). Those areas which have high traffic density were treated as Highly Polluted Area and internal roads passing through the city having less traffic density were treated as Medium Polluted Area and control area is named as Fresh Area. For study purpose leaf samples of *Withania* were collected from the HPA, MPA and FA Sites, and washed thoroughly with water and then immediately fixed in F.A.A Solution. Epidermal peels were obtained and stained with safranine, and examined under compound microscope using 10X eye piece & 40X objective lense. The number of stomata and epidermal cells were counted per microscopic field area and length & breadth of stomata measured with help of ocular & stage micrometery. Stomatal index was calculated according to Salisbury (1927), Viz. STOMATAL INDEX = 100S/E+S , Where:- S = No. of stomata, E = No. of epidermal cells.

Sites→ Attributes ↓	UPPER LEAF SURFACE			LOWER LEAF SURFACE		
	FA	MPA	HPA	FA	MPA	HPA
No. of epidermal cells (per field area of microscope).	50.60 ±5.68	51.00 ±5.20	36.84 ±3.92	72.44 ±8.92	61.68 ±6.41	48.36 ±4.74
Stomatal frequency (per field area of microscope).	11.60 ±2.10	12.00 ±2.00	07.20 ±2.00	21.20 ±4.30	18.00 ±2.31	11.52 ±1.92
Length of stomata (μ)	25.57 ±5.00	25.00 ±2.00	38.36 ±2.00	21.84 ±3.00	21.31 ±2.10	34.76 ±3.80
Breadth of stomata (μ)	18.91 ±2.90	17.99 ±2.50	28.90 ±1.65	16.50 ±1.90	16.00 ±2.28	25.70 ±2.00
Stomatal index	18.65	19.05	16.35	22.64	22.59	19.24

TABLE-1:EFFECT OF AUTO EXHAUST POLLUTION ON THE MICROMORPHOLOGY OF *WITHANIA SOMNIFERA*. Values are in mean (n=25) with S.D.

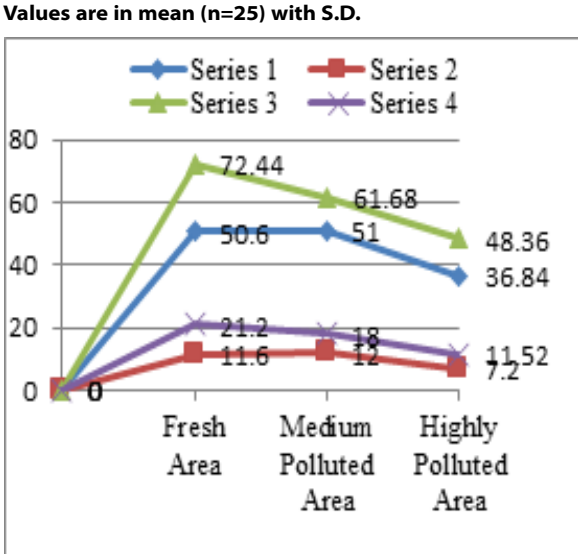

Figure1: Presence of single guard cell & distorted shaped stomata in the leaf samples of *Withania somnifera* collected from polluted area.

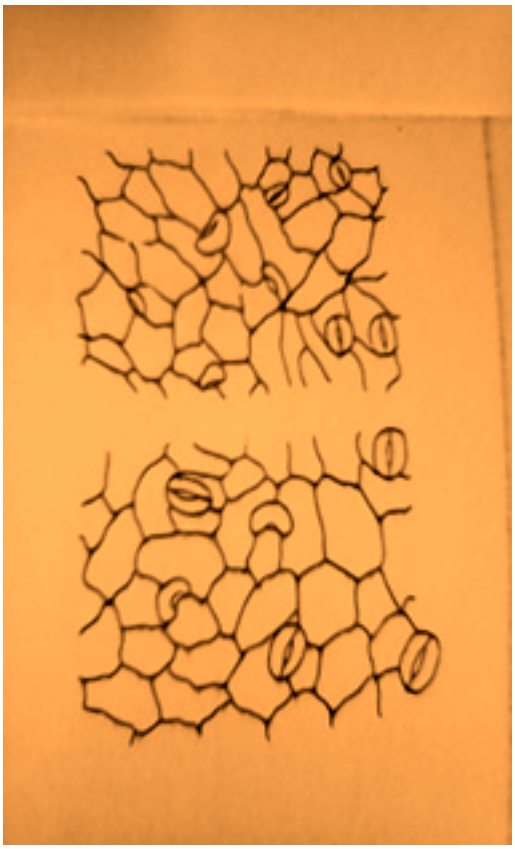

Figure-2:Showing no. of epidermal cells & stomatal frequency on upper & lower surface of *Withania* leaf.

RESULTS & DISCUSSION

Table1 & Fig.2 reveals that the number of epidermal cell increased by 0.79% at MPA but remarkable decline of 27.19% was noticed in samples collected HPA Site, on upper surface of leaf. On other hand decrease was noticed in same the parameter by 14.85% & 33.24% at MPA & HPA Sites respectively. Stomatal frequency showed slight increase (3.45%) at MPA, following sharp decrease of 37.93% in upper leaf surface, whereas decline was recorded by 15.09% & 45.66% at MPA & HPA Site respectively in lower leaf surface. The length & breadth of stomata shows slight decrease at MPA followed by remarkable increase in stomatal dimensions at HPA Site in upper as well as lower leaf surface. Stomatal index increased by 2.41% at MPA Site & showed sharp decrease by 12.33% at HPA Site in upper leaf surface, in lower leaf surface noticed inhibition of 0.22% & 15.02% at MPA & HPA Sites respectively. Some abnormalities like-presence of single guard cell & distorter shaped stomata/guard cell were noticed on upper as well as lower leaf surface (Fig. 1).

In leaf samples of *Withania* collected from polluted area decreased number of stomata & epidermal cells were noticed, similar results were reported by Samal & Santra,2002; Raina & Agrawal,2004; Raina & Sharma,2006; Raina & Bala,2007. In the present study the number of stomata has decreased but length & breadth has remarkable increase of 50.01% & 52.83% in upper & 59.16% & 55.76% in lower leaf surface, respectively. This increased sized stomata may be an adaptation to facilitate proper gaseous exchange. Some workers have reported increased number of stomata in some plants growing under stress conditions of air pollution (Pal et al.,2000 & Raina & Sharma,2003). This increased number or size of stomata both are adaptation in stress effected plants for proper gaseous exchange. Distorted shapes of stomata was also reported in *Pongamia pinnata* by Rai & Mishra,2013. In *Withania* presence of single guard cell might have resulted due to some physiological injury within the leaf, distorted shapes of stomata might be due to lowering of pH in cytoplasm of guard cells & thus changing turgor relations of stomatal complex (Kondo et al.,1980).

So, conclusion of this study is that *Withania somnifera* is sensitive to auto exhaust pollution and to cope up with the stress of auto-exhaust pollution the plant has developed certain changes. These changes could be used as indicators for pollution, can be utilized for further studies.

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