

## Impact of Urban Air Pollution on Epidermal Traits of *Amaranthus viridis* Growing along the Road Side

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*The present paper deals with the study of the impact of urban air pollution on epidermal traits. The light microscopic studies of **Amaranthus viridis** leaves showed marked alteration in the micromorphological parameters. Increase in the number of epidermal cells was recorded in the samples of polluted area on both upper & lower surface of leaf. But decline was noticed in stomatal frequency, dimensions of stomata and stomatal Index in stressed area leaf samples on both the surfaces. These parameters are useful as indicators of environmental stress or pollution.*

**Keywords:** Epidermal traits, *Amaranthus viridis*, Stomatal frequency, Stomatal index.

### 1. INTRODUCTION

Foliar surface is the direct phase of contact between the plant and the atmosphere. Stomata are present on upper and lower surface of leaves and they are the major sites of gaseous exchange, so the effect of pollutants is first noticed here in plants. The automobiles are major sources of air pollution in urban areas. There are variety of plants growing along the road sides and are exposed to auto exhaust pollution. Plant species differ in their capacity to mitigate automobile pollution due to difference in their leaf surface characteristics such as cuticle, epidermis, stomata and trichomes [1]. Adverse effect of urban air pollution on leaf architecture of plants has been studied by several workers [2,3,4]. The present study was conducted in Industrial Town Ghaziabad which comes under National Capital Region (NCR). National Highway No. –2, 58 & 91 passes through this Industrial Town and increased vehicular density & load is posing threat to air quality of the environment of Ghaziabad and adversely effecting the road side flora [5,6].

### 2. METHODOLOGY

For study purpose in city Ghaziabad three sites were selected – Highly Polluted Area [HPA] includes Mohan Nagar Crossing, Meerut Road crossing, New & Old Bus Stand, Hapur Chungi and Lal Kua. Medium Polluted Area [MPA] includes internal road passing through the city having comparatively less vehicular density. Area away from road is treated as control denoted as Fresh Area [FA]. Leaf samples of ***Amaranthus viridis*** commonly called as chauli, belong to the family Amaranthaceae, were collected from the selected sites and thoroughly washed with water and fixed in F.A.A. solution. Micro-measurements have been taken with help standardized ocular micrometer at 400X magnification by preparing temporary mounts of epidermal peels of leaves.

### 3. RESULTS AND DISCUSSION

Observations are presented in Table 1, 2 and Figure 1. The number of epidermal cells (per microscopic field area) increased on both the surface of *Amaranthus* leaves collected from polluted area/sites i.e. MPA & HPA. Such increase in number of epidermal was also reported by other researchers also [7,8,9,10].

**Table 1:** Effect of auto exhaust pollution on stomata of upper leaf surface of *Amaranthus viridis*.

ATTRIBUTES	FA SITE	MPA SITE	HPA SITE
No. of epidermal cells (per microscopic field area)	58.12±8.70	61.28±7.70	64.50±3.90
Stomatal frequency (per microscopic field area)	19.12±2.10	16.36±2.00	12.07±1.43
Length of stomata (µm)	15.71±1.80	14.51±1.80	14.05±1.70
Breadth of stomata (µm)	09.59±1.40	09.45±1.40	09.05±1.50
Stomatal Index	24.75	21.07	18.18

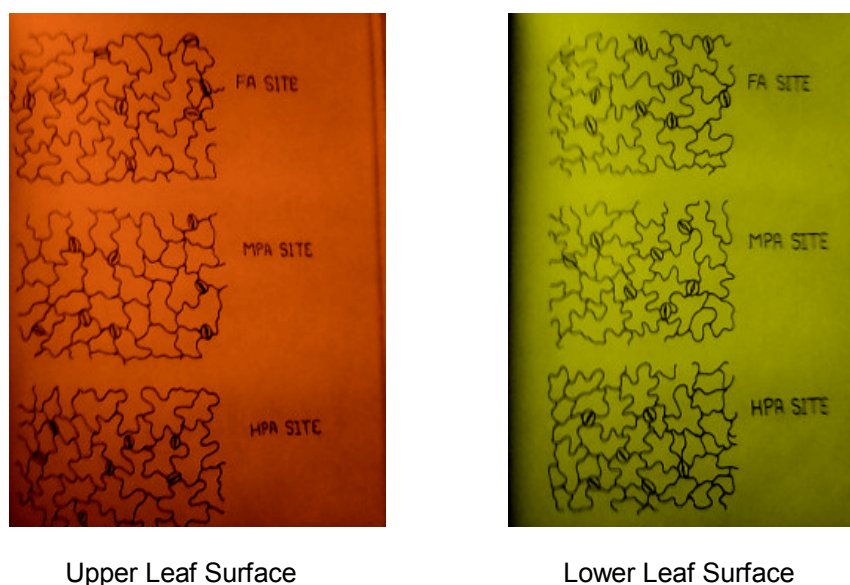
**Table 2:** Effect of auto exhaust pollution on stomata of lower leaf surface of *Amaranthus viridis*.

ATTRIBUTES	FA SITE	MPA SITE	HPA SITE
No. of epidermal cells (per microscopic field area)	53.56±6.60	56.60±6.67	59.60±6.90
Stomatal frequency (per microscopic field area)	19.52±2.90	15.76±2.54	15.00±2.51
Length of stomata (µm)	15.85±2.20	14.52±2.00	14.50±2.00
Breadth of stomata (µm)	10.66±1.83	10.52±1.80	10.50±1.80
Stomatal Index	27.71	26.98	20.11

Values are in mean (n=25) with S.E.

The larger epidermal cells ensure higher amount of antioxidants and thereby better detoxification of pollutants [11]. So, increased number of epidermis might be a better adaptation in plants growing in polluted area for detoxification of pollutant, as the epidermis are the main site where the scavengers first act upon the pollutants. Stomatal frequency decline by 14.44% (upper surface) & 19.26% (lower surface) in the leaf

samples of MPA site and 37.29% (upper surface) and 23.16% (lower surface) in HPA site samples. Dimensions (length & breadth) of stomata were inhibited in the samples collected from auto exhaust polluted areas. Decrease was recorded in Stomatal Index by 14.37% (upper surface) & 02.63% (lower surface) at MPA site and 26.55% (upper surface) & 27.42% (lower surface) at HPA site. Decline in stomatal frequency, stomatal dimensions & stomatal index has been reported by several workers [12,13,14,15,16]. This reduction could be considered as favorable adaptation as it might help in reducing the entry of gaseous pollutant in plants. These changes in leaf surface characters could be considered as the indicators of environmental air pollution.



**Fig. 1:** Micromorphology of *Amaranthus viridis* leaf collected from FA, MPA, HPA Sites.

## REFERENCES

- [1] C. Neinhuis and W. Barthlott; "Seasonal changes of leaf surface contamination in beech, oak and ginkgo in relation to leaf micromorphology and wettability", *New Phytologist*, Vol.138, pp. 91-98, 1998.
- [2] P. Aggrawal; "The effect of auto exhaust pollution on leaf surface of *Cassia siamea* (L) – a road side tree", *Acta Ecol.*, Vol. 22(2), pp. 101-106, 2000.
- [3] S. Kaur; "Stomatal responses of lemon (*citrus medica*) to exhaust from vehicles using different type of fuel", *Poll. Res.*, Vol. 23(3), pp. 451-454, 2004.
- [4] A. Rai and K. Kulshreshtha; "Effect of particulates generated from automobile emission on some common plants", *Food, Agriculture and Environment*, Vol. 4(1), pp. 253-259, 2006.

- [5] A. Pawar; "Impact on the phenological events of plants under stress conditions of auto-exhaust pollution", *Journal of Pure & Applied Sciences & Technology*, Vol. 3(2), pp. 1-4, July 2013.
- [6] A. Pawar; "A survey of road side flora growing under stress of auto exhaust pollution in city Ghaziabad", *Journal of Pure & Applied Sciences & Technology*, Vol. 5(2), pp. 27-32, July 2015.
- [7] S.A. Salgare and S. Swain; "Effect of autoexhaust pollution at Western express highway near National park, Boriveli (East) on the micromorphology of some weed (1-harvest)", *J. Biosphere*, Vol. 3(1), pp. 8-18, 1991.
- [8] A. Pal, K. Kulshreshtra, K.J. Ahmed and M. Junus; "Changes in leaf surface structures of two avenue tree species caused by auto exhaust pollution", *Journal of Environ. Biology*, Vol. 21(1), pp 15-21, 2000.
- [9] A.K. Rana, and A. Sharma; "Effect of vehicular pollution on the leaf micromorphology, anatomy and chlorophyll contents of *Syzygium cumini* L.", *IJEP*, Vol. 23(8), pp. 897-902, 2003.
- [10] P. Rai, and R.M. Mishra; "Effect of urban air pollution on epidermal traits of road side tree species, *Pongamia pinnata* (L.) Merr.", *IOSR Journal of Environ. Sc., Toxicol. & Food Technology*, Vol. 2(6), pp. 4-7, 2013.
- [11] D. Shah, J.G. Gavali and N.S.R. Krishnayya; "Stomatal studies of few tree species growing in industrial area", *Ad. Plant Sci.*, Vol. 13(1), pp. 209-212, 2000.
- [12] A.C. Samal, and S.C. Santra; "Air quality of Kalyani Township (Nadia, West Bengal) and its impact on surrounding vegetation", *Indian J. Environ. Health*, Vol. 44(1), pp. 71-76, 2002.
- [13] A.K. Raina, and B. Aggrawal; "Effect of vehicular exhaust on some trees in Jammu-II", *Journal of Industrial Pollution Control*, Vol. 20(2), pp. 229-232, 2004.
- [14] A.K. Raina and A. Sharma; "Assesment of air pollution and its impact on the leaves of some plant species", *Poll. Res.*, Vol. 25(3), pp. 543-547, 2006.
- [15] A.K. Raina, and C. Bala; "Effect of vehicular pollution on *Polyalthia longifolia* Benth. & HK.f. and *Ipomoea carica* (L) Sweet in Jammu, J&K", *Environment & Ecology*, Vol. 25S(4), pp. 1103-1109, 2007.
- [16] A.K. Raina and C. Bala; "Effect of vehicular pollution on *Duranta repens* L. in Jammu city", *Journal of Applied and Natural Science*, Vol. 3(2), pp. 211-218, 2011.