



FOLIAR DUST DEPOSITIONS ON URBAN PLANTS

Nitesh Joshi, Ambika Joshi*

DEPARTMENT OF BOTANY, RIZVI COLLEGE OF ARTS, SCIENCE AND COMMERCE,
BANDRA(W), MUMBAI 400050, MAHARASHTRA, INDIA.

*DEPARTMENT OF BOTANY, JAI HIND COLLEGE, CHURCHGATE, MUMBAI – 400020,
MAHARASHTRA, INDIA.

E-MAIL: niteshcjoshi@gmail.com

ABSTRACT. Studies of dust deposition on plants growing along road dividers in the city of Mumbai was carried out in December-2009 and March-2010. Foliar dust from the most commonly grown ornamental plant species found in the city, *Bougainvillea spectabilis* Willd, *Ficus benjamina* Linn., *Nerium odorum* Aiton and *Pedilanthus tithymaloides* Poit. was estimated to understand the dust their capturing potentials. The leaves of these were collected from three different sites within the city viz, Colaba, Western Suburb and Western Express Highway. Each site differed in the type of vehicles and the study was aimed at comparing dust fall in different areas of the city. *Nerium odorum* Aiton showed maximum dust capturing capacity. The area Colaba, was relatively less dusty in comparison to other sites. The study shows that plants can be effectively be used to monitor dust and mitigate the problem to some extent.

KEY WORDS: dust, urban plants, phytomonitors, green belt choice

INTRODUCTION:

Mumbai is a densely polluted and populated city. SPM (Suspended Particulate Matter) is a major contributor to air pollution. The Air Quality Laboratory, at Khar shows high concentrations of SPM within the city (Table 1). Urban trees have effectively being used in the city in past to assess the level of dust pollution in the city [1, 2 and 3]. Leaf morphology, phyllotaxy and surface characteristics play very important role in dust capturing capacities of plants [3]. Automobile exhaust pollution are the primary cause of air pollution in urban areas (60%) followed by industries (20 – 30%) and fossil fuel [4]. Bio-monitoring of air pollutants through the use of plants, microbes and animals has now become a standard procedure in the study of air pollution ecology [5]. Particulates are deposited on plant surface by three processes – sedimentation by

gravity action, impaction under the influence of precipitation. It has been suggested that impaction is the principal means of deposition [6]. Dust is captured by leaves of plants, leaf epidermal outgrowths like hairs and scales, hairy axils of stems & leaf bases etc. [7].

Several studies have been conducted on the effects of air pollutants on plant in India and elsewhere since past several decades. Rao [8] have listed plants in respective localities with higher dust capturing capacities absorb and combat pollution. The current work was undertaken to assess the dust deposition on the leaves of plants growing along the city roads having different traffic densities and to observe the variation in dust deposition on leaves with respect to species and season.

Table 1: SPM Levels at various localities in Dec-09 and Mar-10 in micrograms/m³

Sites	SPM (December, 2009)		SPM (March, 2010)	
	Average	Maximum	Average	Maximum
Worli	303	347	216	353
Khar	394	430	329	591
Andheri	276	331	320	621
Borivali	162	206	202	202

Courtesy, Air Quality Monitoring Laboratory, Khar, Mumbai. CPCB STANDARDS200micrograms/m³

METHODS:

The Study Area: Dust Impaction and sedimentation on the leaves of different plant species was studied at 3 areas of the city of Mumbai.

I- COLABA(C): Predominantly moderate traffic along the roads receiving sea breeze and salt spray. Mainly private vehicles are seen at this site.

II- WESTERN SUBURBS(WS): The site ranges from Bandra to Borivali. Moderate to heavy traffic, sea-breeze in certain areas and construction activity are noticed.

III- WESTERN EXPRESS HIGHWAY(WEH): The site ranges from Bandra to Dahisar. Construction activities and high traffic of all types of vehicles is seen at this site. The air quality data of Khar of western suburbs in Mumbai and Worli closer to south Mumbai is represented in Table 1. The data was obtained from MCGM Air Quality Monitoring and research Laboratory, Khar

Collection of Plant samples:

The leaves of plants growing along the road dividers at Colaba, Western Suburb and Western Express Highway were collected in the months of December 2009 and March 2010. The common species studied at all the three sites were *Bougainvillea spectabilis* Willd, *Ficus benjamina* Linn., *Nerium odorum* Aiton and *Pedilanthus tithymaloides* Poit.. The leaves were collected in Zipper lock bags and brought to the laboratory, and washed with 100 ml water using a brush in a beaker, and then traced on a graph paper and leaf area was

calculated. The water containing the dust was filtered through pre-weighed Whatman's No. 1 filter paper and the filter paper was dried in the oven at 80°C. The dried filter paper was weighed and the difference was noted. The amount of dust present on the leaf is expressed as gm/m².

RESULTS:

The results of dust present on the leaves collected in December 2009 and March 2010 from all three sites in Mumbai are represented in Table 2. It is observed that the maximum dust in in the month of December was recorded at Colaba, 18 gm/m² was present on the leaf surfaces of *Nerium odorum* Aiton being, 19.3 gm/m² at Western Suburb and 21.1 gm/m² at Western Express highway. Similarly in March also *Nerium odorum* Aiton leaves were found to be best dust capturer with values 30 gm/m² at Colaba, 39.67 gm/m² at Western Suburb and 64 gm/m² at Western Express highway.

Table 2: Dust in gm/m² on leaves of plants on road at Colaba, Western Suburb and Western Express Highway in Dec-09 and Mar-10

PLANT SPECIES	C DEC 2009	C MAR2010	WS DEC2009	WSMAR 2010	WEHDEC 2009	WEH MAR 2010
<i>Bougainvillea spectabilis</i> Willd	1.17	1.2	2.87	5.6	20	11.1
<i>Ficus benjamina</i> Linn.	3.4	3.5	3.33	4.41	18	21.1
<i>Pedilanthus tithymaloides</i> Poit.	6.06	6.2	7.92	20	14.6	27.9
<i>Nerium odorum</i> Aiton	18	30	19.3	39.67	21.1	64

C = Colaba, WS = Western Suburb and WEH = Western Express Highway

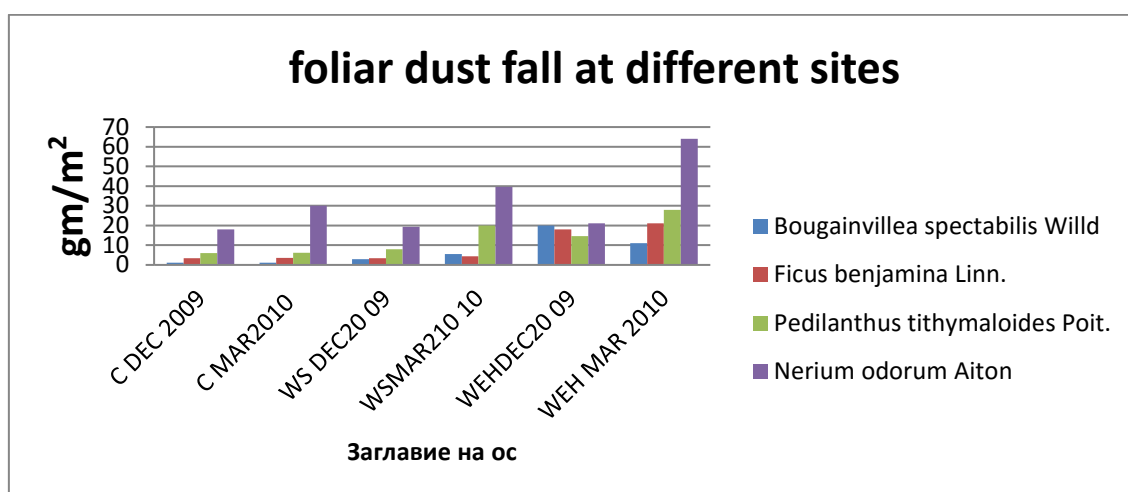


Fig 2: Dust values at Colaba, Western Suburb and Western Express highway in Dec-09 and Mar-10

Colaba area showed least amount of dust on the leaf surfaces of all the plant species, in both the study periods. This is largely due to the area being close to the sea, no three wheelers are allowed to run in this area and restrictions for trucks to run in this area. High foliar dust values were observed at Western Express Highway in both the study periods, this is largely due to constant traffic movement throughout the 24 hrs along this road which connects it to other states of the country. The dust captured by all the plants was more in the month of March. In both the months *Nerium odorum* Aiton leaves showed maximum dust deposition. *Pedilanthus tithymaloides* Poit. and *Ficus benjamina* Linn. showed moderate dust deposition in both the months.

DISCUSSION:

The entire study shows that *Nerium odorum* Aiton leaves have maximum dust deposition. It has whorled phyllotaxy and epidermal outgrowths on its lower surface. *Pedilanthus tithymaloides* Poit. and *Ficus benjamina* Linn are commonly grown along the road dividers within the city which can also effectively be used for monitoring dust. Western Express Highway, which has high density of vehicles, along with construction activities in its vicinity shows maximum foliar dust deposition on its plants, suggesting that urban plants can effectively be used for monitoring dust. There is a necessity to standardize plants for development of green belt and as phytomonitors of dust. The work throws light on phytoremediation of suspended particulate matter using plants on highways, traffic islands and road dividers. *Nerium odorum* Aiton, *Pedilanthus tithymaloides* Poit. and *Ficus benjamina* Linn. can play a very good role in filtering atmosphere.

REFERENCES:

- [1]. Chapekar, S.B (1990). Air pollution in and around Bombay urban area. final report to Min of envt. And forests. AICP project report on plants and pollution.
- [2]. Joshi N.C (1990). Experiments in Phytomonitoring of Urban Atmosphere. Ph.D. Thesis University of Mumbai.
- [3]. Shetye, R. P., and Chapekar, S. B (1980). Some estimations on dust fall in the city of Bombay, using plants. Vol. 4: pp. 61-70. In: Progress in Ecology. V. P. Agarwal and V.K. Sharma (Eds.). Today and tomorrow's Printers and publishers, New Delhi.
- [4]. Sivasamy and Srinevasam (1997). Environmental pollution and its control by trees. Hindu.
- [5]. Varshney, C.K (1992) Role of plants in indicating, monitoring and mitigating air pollution. In S.K. Wahi, A.K. Agnihotri, J.S. Dharma. Environmental Management In Petroleum Industry. Willey Eastern. pp 401-413.
- [6]. Smith, W. H. (1984). Pollutant uptake by plants. In Treshow, M. Ed. Air pollution and plant life. New York; John Wiley and sons. pp 417-450
- [7]. Das, T. M. (1981). Plants and pollution. Presidential Address, Section of Agricultural Sciences, 68th-Indian Sci. Congr., Varanasi, 1-17.
- [8]. Rao D.N. (1981) Phytomonitoring air pollution. Proc. who workshop on bio indicators indices of environmental pollution. Osmania University.