



## EFFECT OF AIR POLLUTION ON STOMATAL INDEX AND CHLOROPHYLL CONTENT OF LEAVES OF *BOUGAINVILLEA SPECTABILIS*, WILLD. FROM SOME LOCALITIES OF PUNE CITY. (MAHARASHTRA, INDIA)

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### ABSTRACT :

Now a day's air pollution become a serious problem for the modern industrialised world. The main effect of air pollution concern for today's world is changes in the gaseous composition of earth's atmosphere. Changes in gases in air affecting plant growth and development. The present study shows that stomata, stomatal index, chlorophyll content, stomatal size get affected due to stress induced by the air pollutants. Which may further affect the gaseous exchange as well as respiration in plants. This is an indicator of environmental stress. Changes in stomatal structure in characters induced due to the effect of air pollutants seem to be small, but during the survival of the plant in stress, they can be of great consequence.

**KEYWORDS :** air pollution , stomatal index, chlorophyll content, stomatal size.

### INTRODUCTION

Air pollution show ill effect on plant growth such as stunted growth, change in morphology or actual height of plant, and may affect on plants natural life or change in weak root system. Due to pollution plant may reduce the resistance power against the pathogens, insects. It also shows effect on change in leaf colour, change in flower colour. Pollution also shows effect on flowering stage and effect on quality of plant. It may also reduce or vanishes the rare or endangered plants. So also, this cause in effect on biodiversity of plant. Plants are more exposure to environment; more effect of environmental factors is observed on leaves and stems. Therefore, in the present study the effect of air pollution on leaves of plants, by using parameters such as stomatal index, size of stomata, chlorophyll content in leaves are investigated. In the present investigation some localities of Pune city were selected. Pune is one of the rapidly growing industrial cities which in turn polluting environment of Pune city. Therefore, in the present study effect of air pollution on stomatal index and Chlorophyll content of *Bougainvillea spectabilis*, Willd. leaves were made. *Bougainvillea spectabilis*, willd. Is climbing shrub their thin woody stem is clothed with small ovate to elliptic lanceolate dark green leaves.



### MATERIAL AND METHODS:

To study the effect of air pollution on *Bougainvillea spectabilis*, willd leaves were collected from some localities of pune city mention in the table no.1.

**Leaf area:**To measure the leaf area the leaves were placed on a millimetre graph paper and outline of the leaf area was drawn with help of pencil. Then by counting the total area covered by the leaf from marked

outline of the leaf and express as a square centimetre. [Ref: S. C. Santra] The average of 15 leaves was taken as a final measurement of leaf area.

**Stomatal Index and Size of Stomata:** Stomatal index (SI) was calculated by number of stomata (S) divided by total number of epidermal cells plus total number of stomata (E+S) into hundred. Stomatal size was calculated by ocular micro-meter method.

**Chlorophyll estimation:** by using Arnon (1949) method chlorophyll content was calculated.

**Table no. I. Leaf area and stomatal index of *Bougainvillea spectabilis* leaves of each place tabulated below:**

Sr. No.	Area	Leaf area/cm <sup>2</sup>	Stomatal Index	
			Lower epidermis Avg.SI value	Upper epidermis Avg.SI value
I	Greenhouse	26.70	27.34	11.37
II	Kamala Nehru Uddyan	27.60	27.20	11.22
1	Agriculture college, Pune Vidyapeeth road	11.95	8.01	-
2	Law college road	24.20	9.11	4.5
3	Hotel Rangoli, Bhandarkar road	21.39	10.15	-
4	Ghole road	17.10	11.75	-
5	Hotel Pride, Pune Vidyapeeth road	26.30	11.16	-
6	Sancheti hospital	20.00	12.15	-
7	Mhatre bridge	8.87	14.01	-
8	Rajaram Maharaj pool, Vithalwadi	16.75	14.15	3.5
9	Aundh road	14.55	14.75	-
10	Bremen maitri chowk	20.00	14.99	4.4
11	Wadgaon phata	18.35	14.78	5.5
12	Shivaji military school	17.07	13.75	-
13	Symbiosis	11.95	13.78	-
14	Katraj dairy	27.70	15.15	-
15	Bapat road	12.60	15.65	-
16	Katraj PMT depot	12.71	14.78	-
17	Bangalore highway over bridge	16.20	16.00	-
18	Corporation bridge	12.40	16.38	6.8
19	Vithalwadi Mandir	17.84	17.00	6.5
20	Bhide hospital, Shastri road	28.45	17.05	6.5
21	Bharati vidyapeeth	18.07	17.38	-
22	Sawarkar Bhavan	18.80	16.78	7.0
23	Chaturshrungi	16.03	15.09	-
24	Film Institute	20.47	16.88	-
25	Nalstop	11.61	16.50	-
26	Ramkrishna math	14.30	17.00	-
27	Maharashtra sahitya parishad, tilak road	13.60	18.35	-
28	Shukravar peth	17.07	16.32	6.7

29	Vithalwadi jakat naka	15.21	18.00	5.5
30	Garware balbhavan	17.85	18.15	7.0

**Table no.II: -Chlorophyll content in leaves of *Bougainvillea spectabilis* of each place tabulated below.**

Sr. No.	Area	Chl.-a mg/gm	Chl.-b mg/gm	Total-Chl. mg/gm
I	Greenhouse	<b>0.000590</b>	<b>0.00256</b>	<b>0.00301</b>
II	Kamala Nehru Udyan	<b>0.000401</b>	<b>0.00204</b>	<b>0.00390</b>
1	Agriculture college, Pune Vidyapeeth road	0.000301	0.00090	0.0012
2	Law college road	0.000273	0.00105	0.00136
3	Hotel Rangoli, Bhandarkar road	0.000325	0.00119	0.00152
4	Ghole road	0.000319	0.00129	0.00165
5	Hotel Pride, Pune Vidyapeeth road	0.000350	0.00136	0.00171
6	Sancheti hospital	0.000341	0.00143	0.00182
7	Mhatre bridge	0.000456	0.00155	0.00187
8	Rajaram Maharaj pool, Vithalwadi	0.000304	0.00157	0.00188
9	Aundh road	0.000403	0.00183	0.00203
10	Bremen maitri chowk	0.000383	0.00178	0.00228
11	Wadgaon phata	0.000421	0.00190	0.00228
12	Shivaji military school	0.000430	0.00180	0.00233
13	Symbiosis	0.000550	0.00192	0.00235
14	Katraj dairy	0.000410	0.00196	0.0024
15	Bapat road	0.000469	0.00196	0.00243
16	Katraj PMT depot	0.000463	0.00201	0.00255
17	Bangalore highway over bridge	0.000409	0.00214	0.00255
18	Corporation bridge	0.000478	0.00210	0.00257
19	Vithalwadi Mandir	0.000427	0.00216	0.00259
20	Bhide hospital, Shastri road	0.000489	0.00213	0.00261
21	Bharati Vidyapeeth	0.000444	0.002193	0.00263
22	Sawarkar Bhavan	0.000460	0.00220	0.00266
23	Chaturshrungi	0.000653	0.00204	0.00269
24	Film Institute	0.000311	0.00236	0.00275
25	Nalstop	0.000448	0.00237	0.00282
26	Ramkrishna math	0.000453	0.00239	0.00284
27	Maharashtra sahitya parishad, tilak road	0.000484	0.00232	0.00288
28	Shukravar peth	0.000484	0.00232	0.00288
29	Vithalwadi jakat naka	0.000495	0.00245	0.00294
30	Garware balbhavan	0.000485	0.00249	0.00298

### RESULT AND DISCUSSION:

Our present study area includes some localities in pune city. Within this study the effect of air pollution on plants deserved great attention. Careful analysis of effect of air pollution on samples collected in the winter and summer season at the height of 1.5 to 2 meters of *Bougainvillea spectabilis*, Willd leaves has been carried out from Pune city.

The study was also designed to determine the environmental impact of pollutants emitted by combustion of heavy fuel oil in Pune city. In addition, we measured chlorophyll content; From several sites we found noticeable effect on chlorophyll content of leaves. The effect of air pollutants on stomatal index, opening and closing stomata provides valuable data on impact of environmental pollutants on plants. Particulate matter such as dust, carbon soot deposited on plants mainly on leaves can inhibit normal respiration and photosynthesis mechanism. The dust coating also affects the photosynthesis which in turn affects the chlorophyll content in leaf. The major objective of the present work was to study the effect of pollutant emitted from vehicles on plant leaf chlorophyll pigments, stomatal index and size of stomata. Overall 45 localities of Pune city were selected and studied. *Bougainvillea spectabilis*, Willd showed amphistomatic nature But, from thirty localities studied we found there are about 17 localities where stomata are found only on lower epidermis i.e. hypostomatic condition which can correlate with the effect of environmental pollutants on leaves of *Bougainvillea spectabilis*, Willd. The stomatal index values of these areas also showed slightly less value on lower epidermis. Thus, it may be due to effect of environmental pollutants on leaves of *Bougainvillea spectabilis*. The stomatal index values of these area ranges from 8.01-18.35. When these values are compared with leaves of *Bougainvillea spectabilis* grown in green house showed 27.34 stomatal index value. which indicates that air pollutants affect stomatal index and their frequency. The stomatal index values of other localities also showed less values as compared greenhouse grown *Bougainvillea spectabilis*. (Table No. 1) from these results it can be concluded that stomata get affected due to effect of air pollutants. The stomatal index value of upper epidermis of green house sample also showed high value 11.37 from green house grown *Bougainvillea* plant (Table no. 1). While in other localities sample showed less value than greenhouse sample. Thus, these results indicate that presence of air pollutants in the air affects the stomatal index of *Bougainvillea spectabilis*, Willd leaves. Chlorophyll pigments present in leaves are the main photosynthesis units. Therefore, in the present investigation the effect of air pollutants on chlorophyll pigments was studied. Chlorophyll 'a', chlorophyll 'b' and total chlorophyll mg/l were estimated from each sample (Table II). From thirty samples studied it was found that one to fifteen samples showed less no. of total chlorophyll content, sixteen to thirty samples showed greater content in total chlorophyll content. Thus, it is observed that total chlorophyll content gets affected due to air pollutants. The samples one to fifteen showed less content of total chlorophyll indicates more pollution in these areas. The less content of chlorophyll content may be due to particulate matter such as dust, carbon soot deposited on the surface of leaf which inhibits normal respiration and photosynthesis in leaf. It also interferes the light intensity reaching to mesophyll tissue, which ultimately showed effect on pigment formation. The estimated chlorophyll 'a', chlorophyll 'b' value mg/gm also showed more or less similar trends to total chlorophyll values. In the first fifteen samples the chlorophyll 'a', chlorophyll 'b' showed more content, samples sixteen to thirty showed slightly more content. Thus, from these results it can be concluded that the effect of air pollutants affects the total chlorophyll content as well as chlorophyll 'a', chlorophyll 'b' content.

In the present study observations are also made on size of stomata. The size of stomata of sample collected from greenhouse considered as control sample, where there no pollution showed size of ranging from 7  $\mu\text{m}$  to 8  $\mu\text{m}$  in height and 6  $\mu\text{m}$  to 7  $\mu\text{m}$  in width. When these values were compared with the sample collected from different localities in Pune city showed size of stomata ranging 6.5  $\mu\text{m}$ -7.5  $\mu\text{m}$  in height and 5.5  $\mu\text{m}$ -6.5  $\mu\text{m}$  in width. showed marked difference. These values when compared with sample collected from greenhouse showed marked reduction in size of stomata, which indicates that the environmental pollution shows effect on size of stomata, which in turn affects the mechanism of opening and closing of stomata as well as exchange of gases from stomata, respiration and photosynthesis.

#### REFERENCES:

- Arnon DI. 1949. copper enzymes in isolated chloroplasts, polyphenoxidase in beta vulgaris. plant physiology 24: 1-15. Hiscox JD, Israelstam, GF. (1979).

- Abeyratne VDK, Ileperuma OA (2006) Impact of ambient air pollutants on the stomatal aperture of *Argyrea populifolia*. *Ceylon J Sci* 35(1):9–15
- Allen LH (1990) Plant responses to rising carbon dioxide and potential interactions with air pollutants. *J EnvironQual* 19(1):15–34
- Darrall NM (1989) The effect of air pollutants on physiological processes in plants. *Plant Cell Environ* 12(1):1–30
- Emberson LD (2004) Air pollution and crops, RAPIDC workshop report, SEI-Y, University of York, UK.
- Heck WW, Taylor OC, Tingey DT (1988) Assessment of crop loss from air pollutants. Elsevier Applied Science, London
- Kollist H, Moldau H, Mortensen L, Rasmussen SK, Jørgensen LB (2000) Ozone flux to plasmalemma in barley and wheat is controlled by stomata rather than by direct reaction of ozone with cell wall ascorbate. *J Plant Physiol* 156(5):645–651
- McAinsh MR, Evans NH, Montgomery LT, North KA (2002) Calcium signalling in stomatal responses to pollutants. *New Phytol* 153(3):441–447
- Rahul J, Jain MK (2014) An investigation into the impact of particulate matter on vegetation along the national highway: a review. *Res J Environ Sci* 8(7):356
- Salgare SA, Thorat VB (1990) Effect of auto-exhaust pollution at Andheri (West), Bombay on the micromorphology of some trees. *J Ecobiol* 2(4):267–272