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EFFECT OF DUST DEPOSITION ON CHLOROPHYLL CONTENTS OF ROAD SIDE PLANTS IN NORTH RAJASTHAN

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ABSTRACT

Foliar surface of plants is continuously exposed to the surrounding atmosphere and is therefore the main receptor of dust. This physical trait can be used to determine the level of dust in the surroundings as well as the ability of individual plant species to intercept and mitigate with it. The effect of dust pollution was determined on chlorophyll content of eight different species viz. *Ficus religiosa, Ficus carica, Azadirachta indica, Delbergia sissoo, Ziziphus jujube, Calotropis procera, Acacia nilotica, Gossypium sp.* growing along the roads of Sri Ganganagar City. Significant changes in the level of chlorophyll "a" chlorophyll "b" and total chlorophyll "a+b" were found in the leaves of eight species collected form dust polluted site. This study clearly indicated that the dust deposition effected on the level of chlorophyll pigments in trees which were exposed to road side.

KEYWORDS: Chlorophyll pigment, Dust deposition, Sri Ganganagar City, *Delbergia sissoo.*

INTRODUCTION

Plants have been the major source of drugs in Indian system of medicine and other ancient systems in the world. Earliest description of curative properties of medicinal plants is found in Rig. Veda. Charaka Samhita and Sushrusha Samhita give extensive description on various medicinal herbs, information on medicinal plants in India has been systematically organized. The medicinal properties of certain plants have been known for centuries. More than a quarter of the medicines in use today come from plants, i.e., from traditional medicine. Currently, with the acticve encouragement of the WHO.

Increasing industrialization and anthropogenic activities is the main agent of pollutant discharge into the environment and introduce various harmful substances into the atmosphere. Many industrial plants and heavy traffic may produce heavy metals and other toxic compounds into the atmosphere that may cause adverse health effects in human or animals; affect plant life and impact the global environment by changing the atmosphere of the earth (Ghorbanli et. al., 2007; Raabe 1999; Bakand et. al., 2005; Hayes et. al., 2007). There is no mechanical or chemical device, which can completely check the emission of pollutants at the source. Once the pollutants are released to the atmosphere, only the plants are the hope, which can mop up the pollutants by adsorbing and metabolizing them from the atmosphere. Therefore, the plants, role in the air pollution abatement have been increasingly recognized in recent years. Plants act as a sink or even as living filters to minimize air pollutant by developing characteristic response and symptoms. Moreover, roadside plant leaves are in direct contact with air pollutant, and may act as stressors for these pollutants, hence to be examined for their Biomonitoring potential (Pandey et. al., 2005). The use of higher plants especially different parts of trees, for air monitoring purpose is becoming more and more widespread. A number of air pollution Biomonitoring studies have been performed using leaves of different plant species.

MATERIAL AND METHODS

The research work was done in Sri Ganganagar District, in Rajasthan. This region situated was North-West India. The experiment was conducted at the Seth G.L. Bihani S.D. (PG) College, Sri Ganganagar under Maharaja Ganga Singh University, Bikaner.

Dust Deposition: The amount of dust was calculated by taking the initial and final weight of beaker in which the leaf samples were washed. It was calculated by using the formula.

$$W = \frac{W_2 - W_1}{A}$$

Where W=Dust content (mg/cm^2), W_1= Weight of beaker without dust, W_2= Weight of beaker with dust

A= Total area of leaf in cm^2

Total Chlorophyll Content (TCH): This was done according ot the method described by Arnon[13], 0.3g of fresh leaves were blended and then extracted with 10 ml of 80% acetone and left for 15 min. The liquid portion was decanted into another text tube and centrifuged at 2,500 rpm for 3 min. The supernatant was then collected and the absorbance was then taken

at 645 nm and 663 nm using a spectrophotometer. Calculations were made using the formula below.

Chlorophyll-a =12.7Dx663-2.69Dx645xV/1000W mg/g

Chlorophyll-b =22.9Dx645-4.68Dx663xV/1000W mg/g

TCH = Chlorophyll a+b mg/Dx=Absorbance of the extract at the Wave length Xnm, V=total volume of the Chlorophyll solution (ml) and W=weight of the tissue extract (g).

RESULT AND DISCUSSION

Roadside plants such as chlorophyll-a, b and total chlorophyll, content so that the future effect of dust pollution can be controlled by finding the tolerant species and to know the existence of any relationship with dust deposition and biochemical parameters of plant leaves so that future research can help in abatement of dust pollution by selecting the suitable tolerant plant species. Our goal was to evaluate the relationship between dust deposition and various Biochemical parameters of eight roadside plant species i.e. *Ficus religiosa, Ficus carica, Azadirachta indica, Delbergia sissoo, Ziziphus jujube, Calotropis procera, Acacia nilotica, Gossypium sp.*

Dust deposition capacity varied from a maximum in *Acacia nilotica* (0.37 mg/cm^2) to a minimum in the trend of dust deposition among the species. Leaf external characteristics such as presence/absence of hairs, cuticle, length of petiole, height and canopy (Sharma G.K. and Butler J., 1975, Sharma G.K.1992, Joshi N. and Bora M. 2011, Thakar B.K. and Mishra P.C. 2010). Highest dust accumulation in may be due to its shiny, waxy coating and rough surface with short petiole whereas in case of and may be due to their waxy coating, rough surface with slightly folded margin. Lower dust accumulation in may be due to its smooth, flat surface and absence of folded margin.

Table. 1.1 Dust Deposition(mg/cm^2)on leaves of eight different plant species.

Plant Species	**ihiy (Ficus religiosa)**	**cjxn (Ficus carica)**	**uhe (Azadirachta indica)**	**'kh'ke (Delbergia sissoo)**	**csjh (Ziziphus jujube)**	**vkd (Calotropis procera)**	**ccwy (Acacia nilotica)**	**dikl (Gossypium sp)**
	1	2	3	4	5	6	7	8
Dust amount mg/cm^2	0.13	0.22	0.30	0.17	0.17	0.15	0.37	0.13
Ascending dust deposition ratio	A. indica	D. sissoo	G. sp	F. religiosa	C. procera	F. carica	A. nilotica	Z. jujube
	0.37	0.30	0.22	0.17	0.17	0.15	0.13	0.13

Table. 1.2 Chlorophyll (a,b and total) contents of leaves of eight different plant species.

Name of Species	Chl – a		Chl – b		Total Chlorophyll	
	Dust	Clean	Dust	Clean	Dust	Clean
A	0.021	0.022	0.014	0.039	0.033	0.068
B	0.021	0.023	0.042	0.045	0.065	0.069
C	0.015	0.016	0.026	0.038	0.029	0.032
D	0.023	0.024	0.021	0.033	0.043	0.057
E	0.022	0.024	0.031	0.032	0.054	0.056
F	0.023	0.022	0.018	0.041	0.043	0.044
G	0.023	0.023	0.035	0.036	0.058	0.59
H	0.010	0.015	0.002	0.008	0.015	0.023

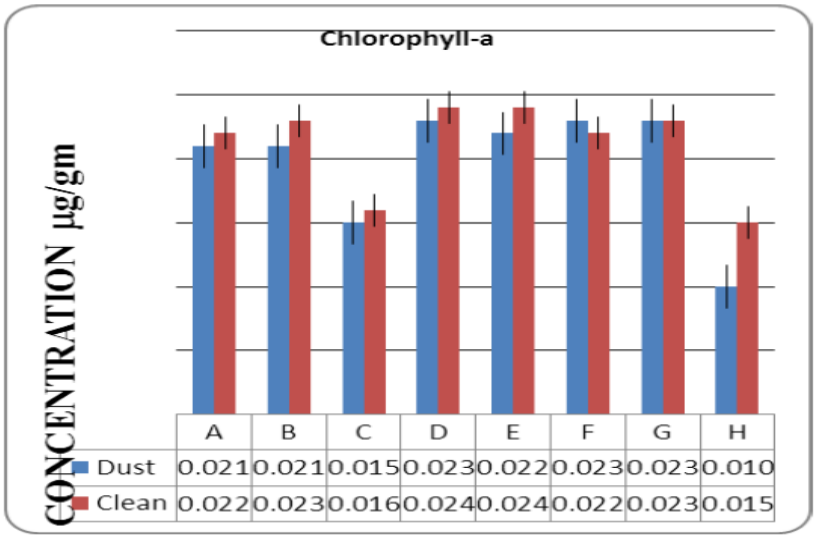

Fig. 1.1: Standard Graph of Chlorophyll – a Estimtaion (645nm & 663nm).

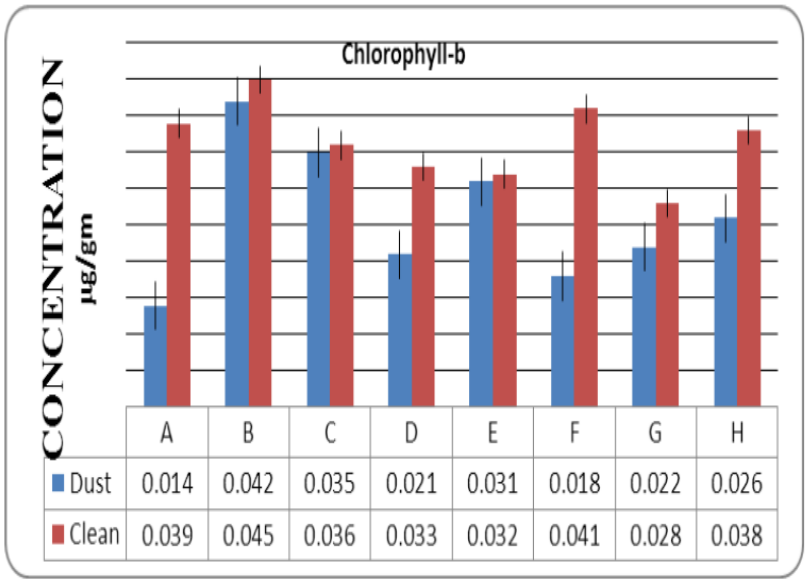

Fig. 1.2: Standard Graph of Chlorophyll –b Estimation (645 nm & 663 nm).

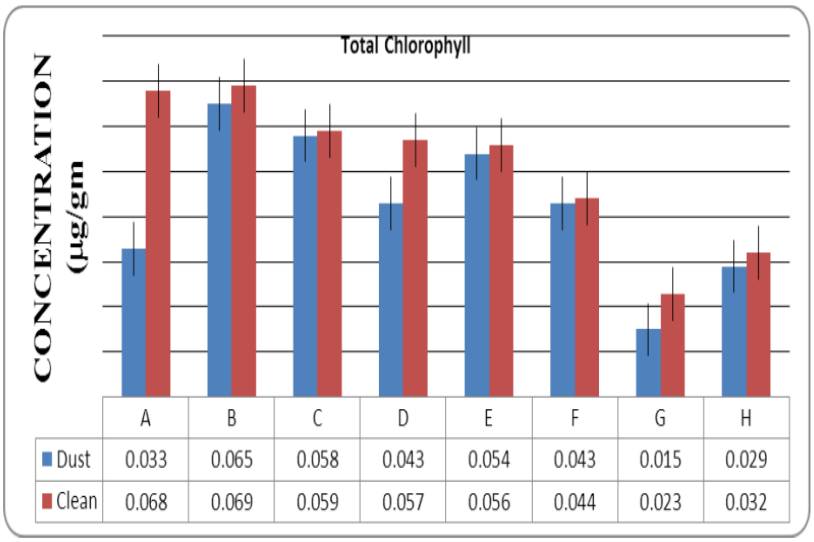

Fig. 1.3: Standard Graph of Chlorophyll- total Estimation (645nm & 663nm).

The variation of Total chlorophyll content of selected plant species under study is shown in table-1.2, (fig. 1.3). All the plant species exhibited maximum chlorophyll content in *Ficus carica* (0.069 µg/gm) The variation in chlorophyll content of selected plants may be due to the dust particles. Dust accumulation causes severe damage in the photosynthetic apparatus (Griffths H, 2003). Deposited dust on the surface of leaf alters its optical properties particularly the surface reflectance in the visible and short wave infrared radiation range (Naik DP, Ushamani, Somasekhar RK, 2005, Heerden PDR, Kruger GHJ, Louw MK, 2007) and the amount light available for photosynthesis. The reduction in chlorophyll content may be due to maximum dust accumulation on the leaf surface and its interference with incident light intensity, leading to a reduction in net photosynthesis. Dust deposition also interferes with gas diffusion between the leaf and air by blocking the stomatal pores. Further the decline in chlorophyll content in the leaves may be due to the alkaline condition created by dissolution of chemicals present in the dust particles, responsible for chlorophyll degradation. Dusted leaf surface causing reduction in chlorophyll content is responsible for reduced photosynthesis (Krishna JR, 1999). The highest chlorophyll content of leaf may be due to least dust accumulation in *Acacia nilotica* (0.059 to 0.058 µg/gm).

Table-1.2 reflects the values of total chlorophyll content in the foliar tissues of the selected roadside plants. It was noticed that chlorophyll content decreased with increasing pollution load with maximum reduction that harbours industrial set up and highest vehicular density. The highest total chlorophyll content (0.069 µg/gm) was recorded in *Ficus carica* and the

lowest (0.023 μg/gm) in *Gossypium sp*. Chlorophyll is said to be an index of productivity and it plays an important role in plant metabolism, hence any alteration in chlorophyll concentration may change the morphological, physiological and biochemical behaviour of the plant. It is well evident that chlorophyll content of plant varies from species to species; age of leaf and also with the pollution level as well as with other biotic and abiotic conditions (Katiyar and Dubey 2001).

No change in Chlorophyll-a was seen in *Acacia nilotica* due to dust deposition on leaves (0.023 [clean] to 0.023 [dust] μg/gm). (table 1.2, fig. 1.1).

Maximum decrease of chlorophyll-b was seen in *Calotropis procera* (0.041 to 0.018 μg/gm) and *Ficus religiosa* (0.039 to 0.014 μg/gm) due to dust deposition on leaves and minimum effect of dust deposition on chlorophyll-b was seen in *Acacia nilotica* (0.036 to 0.035 μg/gm). (table 1.2, fig. 1.2).

Total chlorophyll decreased maximum in *Ficus religiosa* (0.068 to 0.033 μg/gm) and minimum effect of dust deposition on total chlorophyll was seen on *Acacia nilotica* (0.059 to 0.058 μg/gm) and *Calotropis procera* (0.044 to 0.043 μg/gm). (Table 1.2, fig. 1.3).

CONCLUSION

Present work provides basic information about the variation in dust accumulation of eight roadside plant species *Ficus religiosa, Ficus carica, Azadirachta indica, Delbergia sissoo, Ziziphus jujube, Calotropis procera, Acacia nilotica, Gossypium sp.* Variation of dust loads positively correlation with the alteration of Chlorophyll contents of the leaf.

Plants were assessed for their tolerance index to have an idea about the dust pollution in Sri Ganganagar District. This work has indicated the suitability of *Acacia nilotica, Delbergia sissoo, Azadirachta indica, Ziziphus jujube* as intermediate tolerant species to dust pollution. It can be utilized for urban plantation and greenbelt development in road side area to reduce the effect of dust pollution on plant Biochemical contents.

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