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EFFECT OF DUST ON NECROSIS AND CARBOHYDRATE CONTENT IN LEAVES OF SOME ANGIOSPERMIC PLANTS OF GVISH.CAMPUS, AMRAVATI (M.S.), INDIA

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ABSTRACT

The effect of dust on leaf injury was observed in fifteen plant species of different families of angiosperms. The leaf area injured in terms of necrosis was studied and percent leaf injury was recorded on different plants of GVISH.institute campus. Out of fifteen plants maximum percent leaf injury was shown by *Pongamia pinnata* and *Ficus religiosa*, while minimum percent leaf injury shown by *Nyctanthus arbor tristis* and *Ficus benghalensis*.The necrosis of the leaves caused due to dust and its effect on formation of carbohydrate content in leaves was determined. The minimum carbohydrate content was found in leaves of *Polyalthia longifolia* and *Bougainvillea spectabilis*, While maximum carbohydrate content is recorded in *Nyctanthus arbor tristis, Ficus benghalensis* and *Annona squamosa*. The chlorophyll pigment gets damaged due to deposition of dust and living tissues gets damaged showing necrosis, it affected the formation of carbohydrate content because of less activity of photosynthesis in leaves that affected carbohydrate content.

KEYWORDS: Dust, Plant species, Leaf, Necrosis, Carbohydrate.

INTRODUCTION

Leaf is a structural unit of a plant produced on a stem which carry photosynthesis. The accumulation of dust particles and formation of a hard cementations layer on plant leaves reduce the rate of photosynthesis. The chemical composition of the dust tends to be homogenous mixture of oxides of Calcium, Potassium, Aluminium, Silica and Sodium which settles into a head mass when it comes in contact with water (Raina et al., 2008). The dust impairs visibility, The particulate dust falling on leaves may cause foliar injuries, reduction in yield, change in photosynthesis and transpiration. Dust pollution has been known to have an adverse effect on plants. The contaminations of dust particles affects nutritional quality of plants and vegetables. Heavy dust generation contains different sizes of dust paticles ranging from 0.001-10000 µm. Roads are a further common source of dust. Dusts may be produced from car exhausts, which are more controllable from the road surfaces. An increased reliance on road transport today is also evident. The increase in quarrying, open-cast mining and road traffic suggest that dust deposition on to vegetation may be increasing (Farmer et al.1991).

Most of the plant communities are affected by dust deposition so that community structure is altered. Increased dust deposition and subsequent reduction in chlorophyll may be positively correlated with reduced photosynthetic efficiency. Carbohydrates are important constituent and source of energy for all living organism. Dust may affected photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants, visible injury symptoms may occur and generally there is decreased productivety. Considering the role of dust particles and its effect on the process of photosynthesis and carbohydrate formation, Present investigation attempted.

MATERIALS AND METHODS

Study area

The Amravati district is situated between 20°32' and 27°46' North latitudes and 76°37' and 78°27' East longitudes. The study was conducted in the G.V.I.S.H. campus of Amravati city in the state of Maharashtra, India. The dust polluted leaves of different plant species were collected from the campus itself in season over a three months from January 2017 to March 2017.

Estimation of Leaf injury

Mature leaves of different plants from polluted site of campus were collected and brought to the laboratory. The chlorotic and necrotic area of the leaves was observed. Leaf of a plant was placed on graph paper and outline of leaf was drawn along the margin with the help of lead pencil. The leaf area was calculated by counting number of squares. The area of leaf is measured in

sq.cm^2. The procedure is repeated from all chlorotic and necrotic areas of different leaves. The percent leaf injury is calculated by compairing total leaf area injury with total leaf area with the help of formula.

$$\% \text{ leaf injury} = \frac{\text{Total injury area of the leaf}}{\text{Total leaf area}} \times 100$$

Estimation of total carbohydrates

The carbohydrate was determined colorimetrically by Phenol–Sulfuric acid method after extraction into the buffer solution of pH 7 (Dubois et al.1951). One gram (1 g) fresh weight of plant leaf material was taken and homogenized with buffer solution of pH-7 using mortar and pestle. About 0.5 ml and 1 ml of the leaf extract were pipetted into separate test tubes and 1 ml of 5 % Phenol was added, followed by rapid addition of 5 ml of conc. H_2SO_4. The contents were shaken thoroughly and subsequently incubated for 40 min. at room temperature for color development. The absorbance was then measured at 490 nm against a reagent blank using visible spectrophotometer. Glucose was used as standard and the results were expressed as mg percentage of fresh weight of leaves.

RESULT AND DISCUSSION

Table 1: Effect of dust on leaf injury of some plant species.

S.N.	Name of the plant species	No. of leaves studied	Average leaf area (cm^2)	Leaf area of injured spot (cm^2)	Total area of injured areas (cm^2)	leaf injury (%)
1	*Annona squamosa L.*	10	26	10	7.3	28.84
2	*Bauhinia variegata L.*	10	107	16	15.5	14.48
3	*Bougainvillea spectabilis L.*	10	39.5	2	18.5	14.48
4	*Butea monosperma (L).taub*	10	94.5	30	13.5	14.28
5	*Cassia fistula L.*	10	34	27	5.5	16.17
6	*Ficus benghalensis L.*	10	94	16	8.5	9.04
7	*Ficus religiosa L..*	10	27	21	10	37.03
8	*Morinda citrifolia L.*	10	98.5	10	13	33.76
9	*Nyctanthus arbor tristis L.*	10	45	3	3.5	8.13
10	*Plumeria alba L.*	10	46.5	1	5	10.75
11	*Polyalthia longifolia L.(son.).Th.*	10	37.5	10	11.5	19.33
12	*Pongamia pinnata (L).Pierre*	10	47.5	1	2.3	48.42
13	*Sapindus mukorossi L.*	10	8.5	12	11	12.94
14	*Spathodia campanulata L.*	10	19.5	9	7	14.8
15	*Tabebuia argentea L.*	10	31.5	7	5.5	17.46

Accumulation of dust particles damage many green cells of leaves, marginal yellow brown patches representing damage of leaves.These patches are harmful to leaves and they reduce the pigmentation. Similar effect shows (Table 1) in *Ficus religiosa, Pongamia pinnata, Morinda citrifolia, Bougainvilliea spectabillis.* Chlorosis is the phenomenon of leaves yellowing due to the loss of chlorophyll. Necrosis means the wilting of leaves due to the lack of Chlorophyll. Chlorosis and Necrosis occur due to exposure to atmospheric pollutants like dust particles, smoke etc. for measuring the extent of chlorosis and necrosis samples of leaves were collected randomly from different sites and heights. The leaves exhibiting chlorosis and necrosis was treated as injured leaves. (Carlson R.E., Simpson J., 1996).

Dust can cause the leaf injury are stomata damage, premature senescence and can decrease photosynthetic activity, disturb membrane permeability and reduce growth and yield in sensitive plant species. i.e chlorosis and necrosis. Those similar effect was observed by Agrawal and Deepak (2003), Someshkar, et al.(1999) carried out the work on dust pollutions monitoring in stone quarry area. According to their study the deposition level on leaf surface and its subsequent response for chlorophyll content and dust holding capacity. The plants growing at the cross-roads of polluted region may be due to long term exposure of these plants to pollutants like SO2, NO2. The synergistic effects of these pollutants caused foliar injury i.e. chlorosis and necrosis, which degrade the chlorophyll pigments. The same view has been reported by Rao and LeBlanc (1996), and Malhotra (1976).

The chlorophyll pigment were reduced in dust exposed plant species compared with control, wherein a reduction up to 88% weight of the Chlorophyll greater reduction was observed in Chl. b.The Chl / a /b ratio, Chl./ cartenoid ratio was also reduced, further there was increase in accumulation of the stress indicator Proline and Phenol. The decrease in the chlorophyll /carotenoid ratio in stressed plant suggested that these relationship could be used as an indicator of tolerance and physiological status of the plant under cement dust stress condition. Plant cell contain carbohydrate which is use full for many function of plant anatomy. The efficiency of plant function decides the quantity of plant pigmentation and chlorophyll present in a plant body.

Table 2: Determination of carbohydrate contents in dust polluted leaves.

Sr. No.	Plant species	Weight of sample (gm)	Total volume of extract (ml)	Extract taken for analysis (ml)	Absorbance at 490 nm	Amount of carbohydrate (µg/µl)
1	*Annona squamosa L.*	0.5	10	0.1	0.33	72.45
2	*Bauhinia variegata L.*	0.5	10	0.1	0.29	62.18
3	*Bougainvillea spectabilis L.*	0.5	10	0.1	0.08	24
4	*Butea monosperma (L).taub*	0.5	10	0.1	0.23	51.27
5	*Cassia fistula L.*	0.5	10	0.1	0.35	70.09
6	*Ficus benghalensis L.*	0.5	10	0.1	0.23	74.27
7	*Ficus religiosa L..*	0.5	10	0.1	0.15	36.72
8	*Morinda citrifolia L.*	0.5	10	0.1	0.34	71.27
9	*Nyctanthus arbor tristis L.*	0.5	10	0.1	0.52	104
10	*Plumeria alba L.*	0.5	10	0.1	0.26	56.27
11	*Polyalthia longifolia L.(son.).Th.*	0.5	10	0.1	0.58	14.9
12	*Pongamia pinnata (L).Pierre*	0.5	10	0.1	0.14	34.9
13	*Sapindus mukorossi L.*	0.5	10	0.1	0.18	42.28
14	*Spathodia campanulata L.*	0.5	10	0.1	0.15	36.72
15	*Tabebuia argentea L.*	0.5	10	0.1	0.24	53.09
	S.E.				0.04	5.76
	S. D.				0.14	22.30

Carbohydrates are import constituent and source of energy for all living organism. We studied the amount of carbohydrate in different plant species and found that higher amount of carbohydrate in *Nyctanthus arbor-tristis* and reduction of amount in *Bougainvillea spectabillis.* In these study carbohydrates in polluted leaves were reduced under pollution.

The deviation among the plants samples regarding Carbohydrates contents found analysed to be 22.30 and standard error 5.76. The decrease amount of carbohydrate because the destruction of chlorophyll pigment which cause the reduced rate of photosynthesis. (Skinder 2005). The concentration of carbohydrate is indicator of the physiological activity of a plant and it determines the sensitive of plant to air pollution. Reduction in carbohydrate content as polluted site can attributed to increased respiration and decreased CO_2 fixation because of Chlorophyll deterioration (Tripathi and Gautam 2007). (Davison and Barnes1986) mentioned that pollutants like SO_2, NO_2, and H_2S under hardening condition can cause more depletion of Carbohydrate in leaves of plant growth in Polluted area.

CONCLUSION

Dust affects on the normal mechanism of plant, also damage the leaf surface and injured it causes Chlorosis and Necrosis. Present study shows the highest percentage of leaf injury and loss of chlorophyll pigmentation. The plant leaves are the main organs of impingement which not only reduce dust concentrations through the physiological or biological activities but also reduces dust concentrations of air by absorption and filtration. The effectiveness of a green belt in intercepting and retaining atmospheric pollutants depend on several factors, viz., shape, size, moisture level, surface texture and nature (soluble or insoluble) of both the particulate matter. This study examines the selection of plant species which can be grown around industrial / urban areas in India to minimize effects of air pollutants. The Carbohydrate is a source of energy they utilized the CO_2 and produce carbohydrate residue. CO2 comes through stomata, if stomata is damaged by dust and destruction of photosynthetic pigment which shows the negative effect on production of carbohydrate, ultimately reduce the content of carbohydrate.

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