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Effect of vehicular pollution on avenue trees at road side of N.H. -106 between Saharsa to Madhepura, Bihar, India

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Abstract : A survey was conducted in between Saharsa to Madhepura for the study of effect of vehicular pollution on avenue trees. Altogether 12 plants from road side were studied for Dust, pH, Chlorophyll, Ascorbic Acid, RWC and APTI.

Keywords : Auto mobile exhaustpollution Saharsa Madhepura Dust pH Chlorophyll Ascorbic Acid RWC APTI

INTRODUCTION

Auto mobile exhaust emissions contribute significantly to air pollution. In India, sudden increase in number of vehicles caused tremendous damage to the environment and has increased the intensity of air pollutions in most of the cities of the country. Pollution level in Delhi and Kolkata are at a greater level than that recommended by the world health organization (WHO). In Delhi, the data shows that of the total 3000 metric tons of pollutant belched out every day, close to two-third (66%) is form vehicles. Similarly, the contribution of vehicles to urban air pollution is 52% in Bombay and close to one-third in Kolkata.

Among the important constituents of the petrol engine exhaust are carbon monoxide, Un burnt hydrocarbons, Nitrogen oxides, Particulates and Lead, while diesel engine emits Un burnt hydrocarbons, Nitrogen oxides, Sulphur oxides, Smoke and Odour.

Automobile emission with suspended particulate matter and gaseous pollutants attribute to changes in morphology and efficiency of plants including parameters such as epidermal cell number, stomatal index, pH of leaf, relative water content, chlorophyll content etc.

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METHODOLOGY

The study area was selected on NH-106 from Saharsa to Madhepra which is about 24 Km. from the selected area Trees from road sides were observed and specimens were collected at regular intervals in summer, seasons. Specimens were collected both form road side and from control area. Collected specimens were brought to the laboratory and identified with standard monograph (Botany of Bihar & Orissa- Hens, H.H). Total Chlorophyll Content, dust, pH, Relative Water Content and Ascorbic Acid content of fresh leaves both form study area and control area were determined. APTI was calculated for each plant in each season.

Estimation of Relative Water Content (RWC):

It was determined by Sivakumaran and Hall (1978) method. Individual leaves of different selected plant species were excised and weighed immediately. They were dipped into distilled water in petridishes lined with filter paper. After 8 Hours the leaves were blotted and reweighed. Leaves were than dried at 80^0C for 24 Hours and reweighed. Calculation was carried out using following formula-

$$RWC = \frac{Initial\ Wt. - Dry\ Wt.}{Saturated\ Wt. - Dry\ Wt.} x100$$

Estimation of Chlorophyll:

250 mg of fresh leaves were cut into small pieces and put into 25 ml of 80% Acetone and kept for 24 Hours in dark. The absorbance was taken with 645 nm and 663 nm in spectrophotometer. Total Chlorophyll was estimated by the formula as described by Arnon (1949)-

$$\text{Total Chlorophyll } (\frac{mg}{g} FW) = \frac{20.2\ (A645) + 8.02\ (A663)}{1000X\ FW} X\ V$$

Where,

A_{645} = Absorbance at 645 nm
A_{663} = Absorbance at 663 nm
FW = Fresh weight of Leaves
V = Volume of Chlorophyll Extract

Estimation of Ascorbic Acid:

Ascorbic Acid was estimated by following method

I) Reagents:-

Extractant- 2% Oxalic acid

Dye-2,6Dicholorophenol Indophenol

100 mg of pure dye was dissolved in warm water in a beaker and slowly filtered to 250 ml volumetric flask taking care to dissolve as much dye as possible. Volume was made up to 250 ml and stored in cool place.

Ascorbic Acid:-

25 mg of ascorbic acid powder was weighed out and dissolved to 250ml of 2% Oxalic acid solution in a 250ml conical flask.

II) Preparation of Sample:-10 g fresh green leaves were weighed out and to it 100 ml of 2% oxalic acid was added and it was grinded in mortar. The pulp was taken and transferred to 250 ml volumetric flask and volume was made up to 250 ml. the aliquot was filtered through muslin cloth and this was preserved for final analysis.

III) Standardization:-The dye was filled in a clean burette. 10 ml of standard ascorbic acid (AA) was pipette out and diluted with 500 ml DDW in a conical flask. It was titrated until a pink colour appeared which persists for few minutes. The first appearance of pink colour was taken as an end point. The ml of dye consumed for 10 ml of AA solution is equivalent to 1 mg of AA.

IV) Analysis of Sample:-10ml of aliquat was taken and titrated against the dye and the volume of the dye consumed was noted.

V) Calculation:-

It was calculated by following method

X ml of dye = 1 mg of AA

1ml of dye = 1/x me of AA

yml of dye = y/x mg of AA

Estimation of Air Pollution Tolerance Index (APTI)

APTI was calculated by following formula

$$APTI = \frac{[A(T + P)] + R}{10}$$

Where,

A = Ascorbic acid content in mg/gm
T = Total chlorophyll content mg/gm
R = Relative water content in %
P = pH of leaf extract

RESULT

Total Chlorophyll Content, dust, pH, Relative Water Content, Ascorbic Acid content and APTI of fresh leaves both form study area and control area were determined for each plant in each season as per the method prescribed in Material and Methods. Results were tabulated in Table No. -

Table 1- Estimation of dust deposition on leaves of trees in summer session at road side of NH-106

Sl. No.	Botanical Name	Common Name	Family	Leaf area in cm^2	Wt. of dust/cm^2 in mg
1	*Aegle marmelos*	Bel	Rutaceae	18.44	1.345
2	*Azadirachta indiaca*	Neem	Meliaceae	10.56	0.782
3	*Zizyphus jujube*	Bair	Rhamnaceae	10.52	0.311
4	*Mangifera indica*	Aam	Anacardiaceae	62.80	0.632
5	*Bauhinia variegate*	Kachnar	Caesalpinaceae	148.59	0.127
6	*Cassia fistula*	Amal Tas	Caesalpinaceae	74.31	0.232
7	*Delonix regia*	Gulmohar	Caesalpinaceae	24.91	0.035
8	*Saraca indica*	Ashoka	Caesalpinaceae	59.43	0.141
9	*Nerium indicum*	Kanal	Apocyanaceae	9.48	0.372
10	*Tectona grandis*	Sagwan	Verbinaceae	1145.32	0.961
11	*Ficus bengalensis*	Bargad	Moraceae	195.25	0.645
12	*Ficus religiosa*	Pipal	Moraceae	184.08	1.216

Table 2- Estimation of pH of leaf extract of trees in summer session at road side of NH-106

Sl. No.	Botanical Name	Common Name	Family	pH
1	*Aegle marmelos*	Bel	Rutaceae	5.64
2	*Azadirachta indiaca*	Neem	Meliaceae	5.94
3	*Zizyphus jujube*	Bair	Rhamnaceae	6.22
4	*Mangifera indica*	Aam	Anacardiaceae	4.85
5	*Bauhinia variegate*	Kachnar	Caesalpinaceae	6.79
6	*Cassia fistula*	Amal Tas	Caesalpinaceae	6.45
7	*Delonix regia*	Gul Mohar	Caesalpinaceae	6.62
8	*Saraca indica*	Ashoka	Caesalpinaceae	6.47
9	*Nerium indicum*	Kanal	Apocyanaceae	6.92
10	*Tectona grandis*	Sagwan	Verbinaceae	6.50
11	*Ficus bengalensis*	Bargad	Moraceae	5.02
12	*Ficus religiosa*	Pipal	Moraceae	7.16

Table 3- Estimation of relative water content in leaves of trees in summer session at road side of NH-106

Sl. No.	Botanical Name	Common Name	Family	Relative Water Content
1	*Aegle marmelos*	Bel	Rutaceae	41.23
2	*Azadirachta indiaca*	Neem	Meliaceae	64.51
3	*Zizyphus jujube*	Bair	Rhamnaceae	55.27
4	*Mangifera indica*	Aam	Anacardiaceae	71.45
5	*Bauhinia variegate*	Kachnar	Caesalpinaceae	71.52
6	*Cassia fistula*	Amal Tas	Caesalpinaceae	59.51
7	*Delonix regia*	Gul Mohar	Caesalpinaceae	55.61
8	*Saraca indica*	Ashoka	Caesalpinaceae	53.54
9	*Nerium indicum*	Kanal	Apocyanaceae	79.52
10	*Tectona grandis*	Sagwan	Verbinaceae	68.52
11	*Ficus bengalensis*	Bargad	Moraceae	91.44
12	*Ficus religiosa*	Pipal	Moraceae	91.77

Chlorophyll estimation of trees in summer session at road side of NH-106

SI. No.	Botanical Name	Common Name	Family	Total Chlorophyll in mg/g
1	*Aegle marmelos*	Bel	Rutaceae	0.0056
2	*Azadirachta indiaca*	Neem	Meliaceae	0.0226
3	*Zizyphus jujube*	Bair	Rhamnaceae	0.0051
4	*Mangifera indica*	Aam	Anacardiaceae	0.0185
5	*Bauhinia variegate*	Kachnar	Caesalpinaceae	0.0193
6	*Cassia fistula*	Amal Tas	Caesalpinaceae	0.0204
7	*Delonix regia*	Gul Mohar	Caesalpinaceae	0.0250
8	*Saraca indica*	Ashoka	Caesalpinaceae	0.0223
9	*Nerium indicum*	Kanal	Apocyanaceae	0.0088
10	*Tectona grandis*	Sagwan	Verbinaceae	0.0351
11	*Ficus bengalensis*	Bargad	Moraceae	0.0230
12	*Ficus religiosa*	Pipal	Moraceae	0.0177

Ascorbic acid estimation of leaf extract of trees in summer session at road side of NH-106

SI. No.	Botanical Name	Common Name	Family	Total Ascorbic Acid in mg/ml
1	*Aegle marmelos*	Bel	Rutaceae	0.34
2	*Azadirachta indiaca*	Neem	Meliaceae	2.13
3	*Zizyphus jujube*	Bair	Rhamnaceae	0.86
4	*Mangifera indica*	Aam	Anacardiaceae	1.01
5	*Bauhinia variegate*	Kachnar	Caesalpinaceae	0.32
6	*Cassia fistula*	Amal Tas	Caesalpinaceae	0.12
7	*Delonix regia*	Gul Mohar	Caesalpinaceae	1.48
8	*Saraca indica*	Ashoka	Caesalpinaceae	1.98
9	*Nerium indicum*	Kanal	Apocyanaceae	3.92
10	*Tectona grandis*	Sagwan	Verbinaceae	0.43
11	*Ficus bengalensis*	Bargad	Moraceae	0.13
12	*Ficus religiosa*	Pipal	Moraceae	0.16

APTI of trees in summer session at road side of NH-106

Sl. No.	Botanical Name	Common Name	Family	APTI
1	*Aegle marmelos*	Bel	Rutaceae	4.315
2	*Azadirachta indiaca*	Neem	Meliaceae	7.721
3	*Zizyphus jujube*	Bair	Rhamnaceae	6.062
4	*Mangifera indica*	Aam	Anacardiaceae	7.637
5	*Bauhinia variegate*	Kachnar	Caesalpinaceae	7.370
6	*Cassia fistula*	Amal Tas	Caesalpinaceae	6.029
7	*Delonix regia*	Gul Mohar	Caesalpinaceae	6.544
8	*Saraca indica*	Ashoka	Caesalpinaceae	6.639
9	*Nerium indicum*	Kanal	Apocyanaceae	10.668
10	*Tectona grandis*	Sagwan	Verbinaceae	7.133
11	*Ficus bengalensis*	Bargad	Moraceae	9.210
12	*Ficus religiosa*	Pipal	Moraceae	9.292

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