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Effect of Vehicular Pollutants on the Foliage of "*Nerium indicum*L." in Loni, Ahmednagar, M.S.

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Abstract

The use of motor vehicles has been strongly linked to rising levels of air pollution in rural areas as well as all over the world. These motor vehicles also produce huge amounts of carbon monoxide (CO), hydrocarbons (HC), nitrogen oxide (NOx), suspended particulate matter (SPM), and other air pollutants into the atmosphere. In the present investigation, the study area was Loni, located in Ahmednagar, and M.S. was selected and investigated for leaf area, length, width, and chlorophyll pigment, i.e., Chl a, Chl b, and carotenoids and xanthophylls. It was interesting to notice that in the control, the leaf region was bigger (31.18 cm2) when contrasted with the leaf region of the dirtied test (18.97cm2).The length of the dirty test was 11.49 cm, which was less when contrasted with the length of the control test, which was 14.78 cm^2. The dirtied test result was 1253.41 mg/g chlorophyll, but the controlled site result was 1729.55 mg/g. In this way, a decrease of 72.4% in chlorophyll content was maintained in the examples from the contaminated locales in contrast with the control. The convergence of chl-b was 385.02 mg/g in the leaf test gathered from a contaminated site, while it was 527.5 mg/g in the example from a control site. The contaminated site tested in this manner had 72.9% less chlorophyll-B content. In the leaf tests, dirtied and control locations yielded 304.11 mg/g and 423.13 mg/g xanthophyll+carotenoids, respectively. Consequently, there was a decrease of 71.87% in the xanthophylls and carotenoids. So this all demonstrates that vehicular poisons influence the physiology and morphology of leaves.

Introduction:

Clean air has been viewed as a limitless, free resource. As the costs of air pollution on human health rise, people are starting to recognise the value of clean air. Pollution has a significant negative impact on health. Premature facilities from cardiovascular and respiratory conditions, as well as illnesses brought on by chronic respiratory conditions like bronchitis and asthma, have increased. According to a World Bank research, there were 1201 million mild illnesses, 19,805 hospital admissions, and 40,350 premature deaths as a result of air pollution. Premature deaths have gone up by 28% in the last four years, while hospital admissions for illness and other conditions have gone up by 30%. According to another study, the burning of biofuels in inadequately ventilated homes results in indoor air pollution, which is responsible for 4,000–5,100 premature deaths per year among women and young children. The use of vehicles contributes to an increase in rural air pollution. Depending on the quality of the gasoline they use and the engine's efficiency, automobiles generate a variety of pollutants. Vehicles also emit fugitive emissions from the fuel they use and the performance of their engines. Fuel fugitive emissions are another sort of pollution from automobiles; the source and amount of these emissions depend on the kind of vehicle, how well it is maintained, etc. Carbon monoxide (CO), nitrogen oxides (NOx), photochemical oxidants, and air toxics, such as benzene (C6H6), aldehydes, 1,3 butadiene (C4H6), lead (Pb), particulate matter (PM), hydrocarbons (HC), sulphur dioxide (SO2), and polycyclic aromatic hydrocarbons, are the main pollutants released as vehicle/fuel emissions (PAHs). Nitrogen oxides and particulates are the main pollutants from diesel-powered vehicles, whereas hydrocarbons and carbon monoxide are the main pollutants from gasoline and gasoline-powered automobiles.

The use of motor vehicles has been strongly linked to rising levels of air pollution in rural areas and all over the world. These motor vehicles also produce huge amounts of carbon monoxide (CO), hydrocarbons (HC), nitrogen oxide (NOx), suspended particulate matter (SPM), and other air pollutants into the atmosphere, which have detrimental effects on the environment and human health. Air pollution from motor vehicles is among the most important and quickly spreading issues in India's metropolitan centres and some of the developing villages, just like it is in many other parts of the world. Vehicle emissions have been identified as one of the main causes of the declining air quality in developing rural areas. The issue has been made worse by the villages' dense populations of vehicles and comparatively high motor vehicle to people ratio. Plants suffer from the effects of air pollution. Recently, the vegetation in Bhopal near the factory, about 2-3 km away, was also damaged by methyl isocyanate gas. Sharma and Rao studied the reactions of *Phaseolusaureus* to SO2 and HF (hydrogen fluoride) contaminants (1985). It is clear that SO2 and HF inhibit plant growth and reduce production in a number of

different ways. The seeds taken from the contaminated plants were inferior to the ones used as a control. The effects of pollutants on leaves included chlorosis and necrosis, which caused a reduction in photosynthetic leaf area. It is understood that SO2 causes foliar injury that eventually turns into necrotic lesions, which inhibits plant growth and lowers the net absorption rate (Katz, 1949; Thomas, 1951; Weinstein and McCune, 1970).
The ammonia escapes through refrigerators, the precooling systems of cold storage rooms, anhydrous ammonia used as fertiliser, or during its production (Treshow, 1970). Although ammonia is a very insignificant air pollutant in terms of its ability to harm plants (Leone, 1979), it has still resulted in necrotic and chloroticinterveinal streaks at great distances from an unintentional release (Taylor, 1973). In a field study, Dubey et al. (1984) noted a reduction in the leaf area of plants growing in a polluted atmosphere. The maximum reduction was in *Azadirachtaindica*, followed by *Mangiferaindica*, while *Clerodendrumindicum* showed little change. Such reductions in leaf area and growth under stressed environmental conditions have been reported earlier (McCune et al., 1967; Pawar et al., 1978). According to research on the effects of vehicular pollution density on the leaf anatomy of the roadside plant Cassia siamea, vegetation near polluted areas exhibited signs of leaf injury, a reduction in the thickness of the leaf lamina, a reduction in the thickness of the xylem cells and phloem cells, and an increase in the number of palisade and spongy cells per unit area (PrettiBala, 2001). Vehicular pollution adversely affects the physiology of plants. Slope and Bennett (1970) analysed the impacts of NO and NO2 on the pace of evident photosynthesis of alfa and oats. Thompson et al. (1970) disinfected navel orange trees ceaselessly with fine degrees of NO2 at 1.00, 0.5, 0.25, 0.12, and 0.06 ppm. Following 35 days, the 2 most significant levels (1.00 and 0.05 ppm) had caused chlorosis of leaves, broad defoliation, and decreased yield. Hence in the present investigation, Pravara Medical Trust (PMT), which is 116-acre campus located in Rahata taluka, Ahmednagar, Maharashtra, India, was selected and efforts were made to investigate the effect of vehicular pollutants on the foliage of *NeriumindicumL.*

Methodology

Collection of samples:

For the collection of samples, we selected the sites at 19°3438 N and 74°2719 E to collect the two samples for the comparative study. One sample was taken from the campus of Pravara Medical Trust, Loni , which is free of vehicular pollution, and another from the campus's perimeter, which is polluted. The polluted sample was collected from the *Nerium* plant, which is planted at the centre and on both sides of the highway where the traffic scenario was observed.A simple hand plucking method is applied to collect the samples from polluted and non-polluted sites. Leaves taken as a sample are put in an ice container to avoid the adverse effect of temperature during transportation from the collection site to the laboratory. Prepare the two samples for further analysis. Make four replicates of each sample for lab analysis**.**

Preparation of samples:

The collected samples were washed with tap water and dried. The adhering water removed by using blotting paper, two samples prepared. One was from a polluted site and the other from a controlled site.Each sample contains 20 leaves taken to calculate leaf area**.**

Leaf area:

The leaf areas of different collected samples were measured by digital leaf area meter. The readings of both samples in terms of length, width, and total leaf area were recorded.

Photosynthetic pigments by DMSO method:

A *Nerium* plant's mature leaves were harvested under two different environmental conditions, one from a busy roadside (a polluted environment) and the other from a campus location away from vehicular traffic (a controlled environment).While plucking the leaves, make sure to take leaves of the same maturity from both. To avoid age-related variations, control and polluted sites were used. The leaves were brought to the laboratory in an airtight zip lock bag. The leaves were washed with double distilled water, wiped to dry, and placed between the folds of tissue paper. **For analysis, four replicates of each sample were made, and 100 mg (0.1 g) of leaf tissue was weighed in fractions (the laminar portion was removed in small fragments to avoid taking the midrib or major veins) with a sensitive weighing balance.**The 100 mg of weighed, leaf cut portions were placed in a pre-labelled falcon tube (15ml).Add 7 mL of DMSO to the tube (use the gradation on the tube for reference). The chlorophyll extraction was carried out by incubating the falcon tubes in a water bath at 65 °C for 1 hour, or until complete discoloration of leaf tissues. After the incubation time, remove the rack from the water bath using oven gloves. For each sample tube, make the volume up to 10 mL using DMSO, and mix using a vortex spin. The absorbance of the supernatant was recorded at 665nm, 649nm, and 480nm using a spectrophotometer with blank as DMSO **(** Shoaf and Lium 1976). If the spectrophotometer absorbance value crosses 1, then dilute using DMSO and incorporate the necessary dilution factor. The amount of chlorophyll was calculated in mg/g of fresh weight by using the formulae given below (Arnon, 1949).Chlorophyll-a (ug/ml) (12.19A665-3.45A649)

Chlorophyll-b (µg/ml)=(21.99A649 - 5.32A665)

Carotenoids+Xanthophylls (µg/ml)= [(1000A480-2.14Chl a-70.16Chl b)/220]

To convert values from µg/ml to mg/g fresh weight multiply each of the result for Chl a, Chl b, and Carotenoids+Xanthophylls with the following:

$$\text{Value in mg/g} = \frac{\text{Value in µg/ml x Volume of total extraction (10ml)}}{\text{Weight of Tissue (grams)}}$$

DFA(Dilution Factor Absorbance

4.0ml DMSO solution is used as DFA. The purpose of adding DFA is to avoid reading or absorbance values which is comes more than 1 because of high concentration of plant extract. That's why the Absorbance value after the dilution is multiplied with amount of DFA(4 ml) for further calculations.

To convert values from µg/ml to mg/g FW fresh weight multiply each of the result for Chl a, Chl b, and Carotenoids+Xanthophylls with the following

$$\text{Value in mg/g} = \frac{\text{Value in µg/ml x Volume of total extraction (10ml)}}{\text{Weight of Tissue (grams)}}$$

Results and Discussions:

Table No.1.Leaf area analysis of Polluted and controlled samples:

Sr.No.	Leaf Area of controlled sample	Leaf Area of Polluted sample	Length of Controlled sample	Length of Polluted sample	Width of Controlled sample	Width of Polluted sample
1.	29.68	16.68	14.52	10.18	2.80	2.11
2.	28.67	15.67	14.94	8.89	2.94	2.23
3.	36.44	23.44	14.34	14.19	2.81	2.40
4.	29.65	16.65	13.27	10.71	2.90	2.12
5.	32.35	19.35	15.14	12.80	2.97	2.12
6.	32.65	19.65	13.72	11.60	2.51	2.20
7.	31.12	18.12	16.86	9.81	3.33	2.33
8.	36.21	24.84	15.14	12.87	3.03	2.60
9.	30.17	17.17	15.54	10.68	3.18	2.13
10.	28.24	15.24	14.39	9.26	2.47	2.14
11.	27.37	14.37	13.90	9.89	2.88	1.99
12.	25.68	12.68	14.87	8.84	2.85	1.94
13.	27.14	14.14	16.21	8.74	2.70	2.13
14.	30.17	17.17	15.59	11.28	2.97	2.10
15.	34.96	21.96	17.01	13.37	3.21	2.30
16.	33.56	20.56	15.12	12.08	2.85	2.36
17.	30.00	21.84	14.17	13.65	2.85	2.19
18.	34.40	23.06	12.35	13.67	2.84	2.30
19.	33.10	27.50	13.97	15.02	2.73	2.56
20.	32.21	19.21	14.62	12.20	2.50	2.16
	Avg:31.18	**18.97**	**14.78**	**11.49**	**2.87**	**2.22**

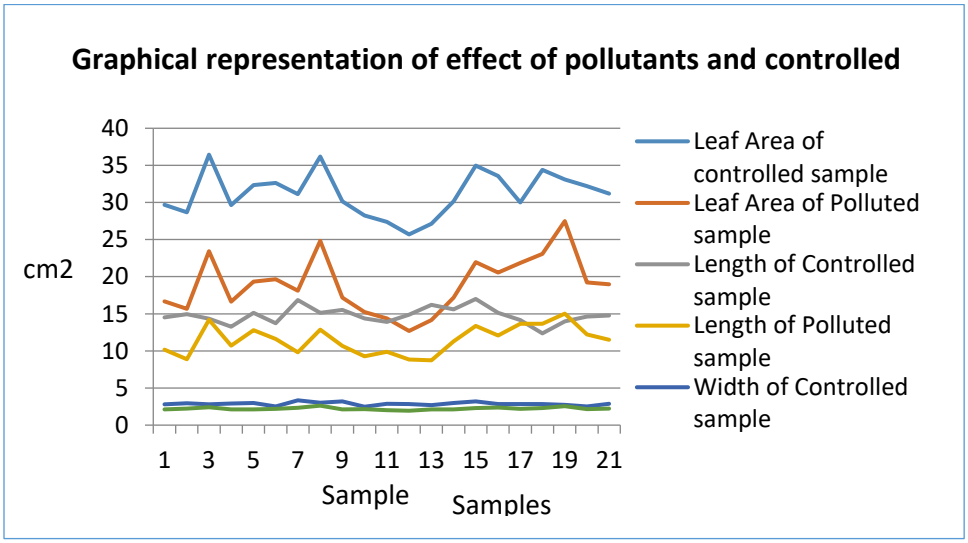


Table No.2 Photosynthetic Pigment analysis of Polluted and controlled samples for the study of effect of pollutants:

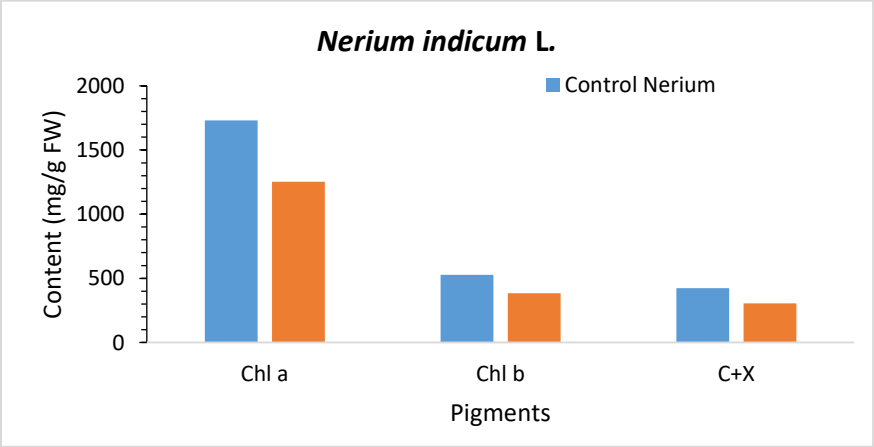
	Absorbance			**DFA(AX4.00ml)**			**ug/ml**			**mg/g FW**		
Sample	**A665**	**A649**	**A480**	**DFA665**	**DFA649**	**DFA480**	**Chl a**	**Chl b**	**C+X**	**Chl a**	**Chl b**	**C+X**
Control Nerium	0.381	0.15	0.349	1.524	0.6	1.396	16.5	5.09	4.6	1650.8	508.6	456.3
Control Nerium	0.36	0.145	0.339	1.44	0.58	1.356	15.6	5.09	4.4	1555.3	509.3	438.8
Control Nerium	0.457	0.175	0.317	1.828	0.7	1.268	19.9	5.67	3.8	1986.8	566.8	376.3
Control Nerium	0.398	0.156	0.333	1.592	0.624	1.332	17.3	5.25	4.2	1725.4	525.2	421.2
Average										1729.6	527.5	423.1
Polluted Nerium	0.356	0.137	0.29	1.424	0.548	1.16	15.5	4.47	3.7	1546.8	447.5	369.5
Polluted Nerium	0.191	0.075	0.168	0.764	0.3	0.672	8.28	2.53	2.2	827.82	253.3	216.6
Polluted Nerium	0.332	0.135	0.278	1.328	0.54	1.112	14.3	4.81	3.4	1432.5	481	338.1
Polluted Nerium	0.278	0.108	0.23	1.112	0.432	0.92	12.1	3.58	2.9	1206.5	358.4	292.2
Average										1253.4	385	304.1

Conclusion and Discussion:

After every one of the tests and investigations, we reason that contamination shows a few unfavourable impacts on leaf morphology and physiology. The contaminated examples, which are exceptionally presented to vehicular contamination, show high residue aggregation on their surfaces, while on the controlled examples there is no amassing of or very little affidavit of residue.

The controlled example shows the leaf region that was bigger (31.18 cm2) when contrasted with the leaf region of the dirtied test (18.97cm2). Contaminations influence the leaf region and forestall the typical improvement of tissues. In different elements, a similar situation was noticed. The length and width of the dirtied test are somewhat not exactly the contaminated examples. The length of the dirtied test was 11.49 cm, which was less when contrasted with the length of the control test, which was 14.78 cm. The collection of residue on the leaf surface and the ingestion of different poisons upset the course of photosynthesis as well as show the unfriendly impact on the action of stomata. The shade of dirtied leaves is marginally pale when contrasted with the shade of a controlled example, which is dim green in variety. The colouration of the leaf relies upon the centralization of chlorophyll shades. Less pigmentation implies less colouration or pale tone. So this all demonstrates that vehicular poisons influence the physiology and morphology of leaves.

Graphical representation of photosynthetic pigments present in samples:



(Fig-Concentration of Photosynthetic Pigment collected from polluted and controlled site)

The concentration of chl-a in the leaves of *Neriumindicum* L. at contaminated destinations was recorded as 1253.41 mg/g, compared to 1729.55 mg/g at the controlled site. In this way, a decrease of 72.4% in chlorophyll content was kept in the examples from the contaminated locales in contrast with the control. The convergence of chl-b was 385.02 mg/g in the leaf test gathered from a contaminated site, while it was 527.5 mg/g in the example from a control site. The contaminated site test in this manner had 72.9% less chlorophyll-b content. In the leaf tests, dirtied and control locations yielded 304.11 mg/g and 423.13 mg/g xanthophyll+carotenoids, respectively.Consequently, there was a decrease of 71.87% in the xanthophylls and carotenoids.

Air contaminations, vehicular poisons, fly debris, and residue emanations significantly affect the convergence of various photosynthetic colours. Dirtied and cleaned leaf surfaces are liable for decreased photosynthetic rates, causing a decrease in chlorophyll content.

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