Bulletin of Pure and Applied Sciences.
Botany, Vol.41 B, No.1.
January-June 2022: P.75-78
Original Research Article

Print version ISSN 0970 4612
Online version ISSN 2320 3196
DOI: 10.5958/2320-3196.2022.00008.8
Available online at www.bpasjournals.com

A Comparative Study on the Chlorophyll Content of *Azadirachta indica* Plantation Suffering from Automobile Pollution from the Meerut City, India

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Received on 04.01.2022
Revised on 21.05.2022
Accepted on 31.05.2022

Keywords:
Automobiles, chlorophyll content, road side pollution, Azadirachta indica.

Abstract
In a comprehensive survey status in suffering leaves of Azadirachta indica in terms of green coloration and photosynthesis efficiency of plants around the various roads of Meerut City, showed of significant change in chl a, chl b and total chl contents and photosynthetic efficiency. The populations of autovehicles are significantly increases in crowded main road crossings of city connecting to Delhi, Muzzaffarnagar, Garh and Hapur. The chlorophylls and photosynthetic efficiency of suffering leaves in hazardously smoke pollution level, significantly decreases with a yellow coloration. However, in a moderate level of air pollution level index areas (i.e., Collectorate, Roorkey Road and Medical College area), efficiency of chlorophyll contents was slightly increases, as carbon dioxide level might indicated the photosynthesis metabolism.

How to cite this article: Tyagi N, Singh R. (2022). A Comparative Study on the Chlorophyll Content of *Azadirachta indica* Plantation Suffering from Automobile Pollution from the Meerut City, India**.** *Bulletin of Pure and Applied Sciences-Botany,* 41B(1), 75-78.

1. INTRODUCTION

The leaves are the aerial parts of a plant concerned with various metabolic processes. As pollutant settle down from the atmosphere, deposited on vegetation. Pollutants have a potential, entering in plant leaves and its cellular spaces, where, they absorbed by plant cells and may react with cell components. Each pollutant interacts its own way in biochemical physiological processes of the plant. Such interference by pollutants of various combinations of different pollutants, often led to change in normal green coloration of the foliage, its anatomy, cytology, physiology and genetically characters of stress plants.

The impact of exhaust, which include various combinations of pollutants might led to decoloration of dark leaves or a change in morphology of affected leaves with yellowing in the susceptible characters in large tree plants (Greitner, 1991; Gupta et. al., 1991).Therefore, a study was conducted to observe the loss of green matter contents (chlorophyll pigments) in lower half leaves of canopy level of selected road side plants of *Azadirachta indica* in different crowded crossings of Meerut City.

2. MATERIALS AND METHODS

Azadirachta indica is belongs to the family Meliaceae, a drought tolerant species, successfully grown along with other plants by

municipal board and Forest Department in city roads. This study planned to find out the level of chlorophyll content between heavy and less polluted areas. The leaves of *Azadirachta indica* were collected as a sample from these areas.

Chlorophyll studies

The Chl a, b and total chl content measured with Arnon's method (1949). 100 mg of leaves homogenized in 80% acetone with $NaHCO_3$. A supernatant collected after centrifugation at 5000 rpm for 5 min, and the final volume was made up 10 ml with acetone. Absorbance measured at 663 nm and 664 nm of and 80% acetone was treated as blank. Chloropyhll a, b and total chl content calculated with formulae:

Chl a(mg/gf.wt.) = [1.27(A663)-2.69(A645)] x V/1000xW

Chl b(mg/gf.wt.) = [22.9(A645)-4.68(A663)] x V/1000xW

Total (mg/gf.wt.) = [20.2(A645) + 8.02(A663)] x V/1000xW

Where
A = Absorbance at specific wave length.
V = final volume (ml) of chlorophyll extract with 80% acetone.
W = weight (g) of fresh leaf tissue.

Table 1: Automobile population number in different crossings of Meerut City: No. of automobiles playing through the various junction of city around 1 km. vicinity area (mean values/day)

		A	B	C	D	E	F	G	H	SEM	CD
Summer	First Year	1825.1	1837.8	1870.8	2482.1	2313.6	2193.7	2088.0	1210.9	±43.27	105.57
	Third Year	2128.8	2114.6	2428.2	2035.0	1815.1	1774.6	1753.3	1167.8	±43.37	105.82
Rain	First Year	900.0	1023.6	1050.7	1913.6	1641.4	1567.6	1552.2	658.5	±43.27	173.70
	Third Year	1107.8	1127.5	1186.3	1762.4	1731.4	1652.9	1659.8	845.9	±31.80	77.59
Winter	First Year	1053.1	1274	1178.4	1821.9	1755.4	1674.6	1703.1	857.5	±31.51	76.88
	Third Year	1109.5	1245.2	1255.9	1870.3	1828.1	1699.8	1765.8	915.5	±104.23	254.32

A-Baghpat Road Crossing, B-Begumbridge crossing, C-Delhi Road Crossing, D-Hapur Road Crossing, E-L, Block Shastri Nagar Crossing, F- Mawana Road Crossing, G- Pallavpuram Road Crossing, H- Railway Road Crossing, I-Control .

Table 2: Effects of automobiles fuel emission on chlorophyll contents (mg g-1 f.wt.) of affected leaves of *Azadirachta indica* (neem) in different study sites in and around Meerut City. (Mean value of chlorophyll 663, chl 645 and total chlorophyll in sample areas).

			A	B	C	D	E	F	G	H	I	CD
Summer	First year	Chl a	1.917* ±0.052	1.937* ±0.036	1.920* ±0.036	1.808* ±0.021	1.937* ±0.036	1.689* ±2.227	1.776* ±4.308	2.276 ±4.995	2.278 ±0.015	0.031
		Chl b	1.083* ±0.059	1.056* ±0.032	1.053* ±0.030	1.050* ±5.268	1.057* ±0.013	1.026* ±1.166	1.040* ±5.670	1.767* ±4.707	1.897 ±0.019	0.041
		T. chl	3.000	2.993	2.973	2.858	2.994	2.715	2.816	4.043	4.175	
	Third year	Chl a	1.915* ±0.051	1.935* ±0.037	1.918* ±0.036	1.806* ±0.021	1.935* ±0.037	1.688* ±2.785	1.774* ±4.195	2.274 ±3.979	2.276 ±0.015	0.031
		Chl b	1.081* ±0.059	1.055* ±0.032	1.050* ±0.028	1.048* ±5.635	1.056* ±0.013	1.024* ±1.095	1.039* ±5.706	1.765* ±4.079	1.894 ±0.021	0.044
		T. chl	2.996	2.990	2.968	2.854	2.991	2.712	2.813	4.039	4.170	

Rain	First year	Chl a	2.010* ±0.076	1.945* ±0.038	1.950* ±0.044	1.811* ±0.024	1.940* ±0.046	1.694* ±9.325	1.778* ±2.449	2.283 ±4.029	2.295 ±0.019	0.040
		Chl b	1.145* ±0.085	1.060* ±0.041	1.059* ±0.032	1.053* ±3.059	1.070* ±5.912	1.030* ±3.162	1.043 ±3.544	1.783* ±3.633	1.905 ±0.060	0.127
		T. chl	3.155	3.005	3.009	2.864	3.010	2.724	2.821	4.066	4.200	
	Third year	Chl a	2.008* ±0.075	1.943* ±0.037	1.948* ±0.044	1.809* ±0.024	1.939* ±0.046	1.692* ±9.221	1.775* ±2.315	2.281 ±5.314	2.293 ±0.018	0.038
		Chl b	1.142* ±0.085	1.059* ±0.042	1.057* ±0.032	1.052* ±2.400	1.069* ±5.170	1.028 ±3.544	1.042* ±3.124	1.781 ±3.249	1.902 ±0.058	0.123
		T. chl	3.150	3.002	3.005	2.861	3.008	2.720	2.817	4.062	4.195	
Winter	First year	Chl a	1.879 ±0.010	1.935 ±0.032	1.908 ±0.046	1.802 ±0.016	1.936 ±0.042	1.686 ±1.414	1.770 ±3.322	2.271 ±5.678	2.267 ±0.035	0.074
		Chl b	1.061 ±0.052	1.051 ±0.016	1.048 ±0.020	1.049 ±4.427	1.054 ±6.480	1.020 ±3.006	1.035 ±2.561	1.755 ±4.317	1.874 ±0.023	0.048
		T. chl	2.940	2.986	2.956	2.851	2.990	2.706	2.805	4.026	4.141	
	Third year	Chl a	1.877 ±0.011	1.933 ±0.032	1.906 ±0.046	1.801 ±0.015	1.934 ±0.043	1.685 ±1.673	1.768 ±3.033	2.270 ±5.932	2.265 ±0.030	0.063
		Chl b	1.061 ±0.052	1.049 ±0.017	1.046 ±4.270	1.046 ±4.270	1.052 ±6.840	1.019 ±2.800	1.034 ±3.741	1.753 ±4.127	1.871 ±0.023	0.048
		T. chl	2.936	2.982	2.952	2.847	2.986	2.704	2.802	4.023	4.136	

A-Baghpat Road Crossing, B-Begumbridge crossing, C-Delhi Road Crossing, D-Hapur Road Crossing, E-L,BlockShastrinagar Crossing, F- Mawana Road Crossing, G- Pallavpuram Road Crossing, H- Railway Road Crossing, I-Control. (value area in mean *significant at 5% level).

3. RESULTS AND DISCUSSION

The study was conducted to observe the loss of green matter contents (chlorophyll pigments) of lower half leaves samples selected of roadside plants (*Azadirachta indica*) in various crossings of Meerut City. In season of winter, rain and summer during the first and third year of study (table 1). Spectral analysis of green matter pigment chlorophylls of lower half canopy of leaves of road side plants and their comparison with control plant in location of cantonment, clearly revealed a reduced amount of total chl, chl 'a' and chl 'b' significantly (table 2).

The amount of chlorophyll in all toxic leaves was approximately equivalent to the amount of chlorophyll 'a' and chlorophyll 'b' in comparing the data of three season in first and third year study. In winter season the pollution effect was greater in all locations of road side plants followed by summer and rainy seasons. The toxicity was maximum pertained in leaves of Hapur road plants (in terms of reduced chlorophyll a, b and total chlorophyll followed by Shastri Nagar> Pallavpuram> Begumpul Road> Mawana Road> Delhi Road> Baghpat Road> Railway Road.

Amount of total chlorophyll 'a' was quite greater, than the amount of chlorophyll 'b' in all selected leaves of toxic plants, might be due to the fact that probably chlorophyll 'a' have a greater ratio and role in photosynthesis mechanism in LHC.1 and LHC.2 systems of chloroplast thylakoids and chlorophyll 'b' might be a assesary supporting pigment of quanta some in chloroplast. Therefore, amount of chlorophyll 'b' was lesser than chlorophyll 'a' in leaves (might be 60-70, 30-40% ratio in chl 'a': chl 'b'.

4. CONCLUSION

It is an obvious fact that, auto vehicular exhaust emission pertained a significant deleterious impact on the pigmentation system of roadside plants of selected crossings in all three season. However, the degree of coloration was maximum in winter followed by summer and rainy season. Conclusively we can say that chlorophylls physiology slightly changes the spectral system of photon absorption; ultimately reduces the chlorophyll efficiency in stress polluted plants leaves.

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