



Impact of Air pollutants on light absorption of leaves of selected tree in Haridwar city, Uttarakhand

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Abstract: The present study was conducted in the year 2021 to find out the impact of Air pollutants on the light absorption of *Mangifera indica* and *Dalbergia sissoo*. Total Chlorophyll content was also assessed of leaves samples collected from the selected study sites. The selected study sites were quite different in terms of pollutant exposure due to the different activities round the clock. A decrease in the amount of light absorption in case of selected trees was seen in higher polluted site as compared to non or less polluted area.

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Keywords: Light Absorption, Total Chlorophyll Content, Photosynthesis, Air pollutants

1. Introduction

Haridwar city is one of the famous pilgrim center, which attracts people for their aesthetic satisfaction. The National River Ganga enters first time in plain at Haridwar and signifies the importance of the city as a place of religious importance. Haridwar hosts several religious festivals throughout the year. During these festivals, a heavy influx of vehicles can be observed. Automobile exhaust and pollutants from the activities has become a serious environmental problem to all types of vegetation (Chauhan and Joshi, 2008).

In last few decades, the rapid urbanization and industrialization has been witnessed by the mountainous state Uttarakhand. Along with these developmental activities, the environmental pollution has become a serious environmental problem to all types biota in the said area (Chauhan and Sanjeev, 2008) and the productivity of the plants are also disturbed by the same (Chauhan and Joshi, 2008). Air pollutants can cause serious setback to the overall physiology of Plants (Mejstrik, 1980; Anda, 1986) and amount of Chlorophyll is related to the vegetation productivity and plant health (Dash and Curran, 2007). Many of the researchers found in their studies that chlorophyll content and light absorption has been negatively affected by the environmental pollution (Tsega and Prasad, 2014; Yunus et.al, 1979; Swami and Chauhan, 2015 and Swami et.al, 2004).

2. Material and Methods

During the present study, the study sites were selected within the range of 15 Km in Haridwar so that a thorough work can be done. Motichoor (Near Railway

Crossing), Ranipur More and BHEL Sec 3 were selected as the study sites. Monitoring of particulate matter (PM10) was undertaken as per the norms prescribed by the Central Pollution Control Board of Govt. of India. The sampling was done for a period of 24 hours on each sampling site, by Envirotech Respiratory Dust Samplers (APM 460) on the same dates and timings. The fresh matured leaf samples of *Mangifera indica* and *Dalbergia sissoo* were collected during the study period of year 2021 on the basis of different seasons. The leaves were collected manually from the bottom of the tree crown, about 8-10 feet above from the soil. The matured leaf samples were collected from nearby branches of tree during the study period.

Chlorophyll content was determined by using the method of Singh et al. (1991). The absorbance of the filtered extract was measured with a UV-Visible spectrophotometer (Model UV-1800, Envirotech) at 645 nm and 663 nm.

3. Results

The results of present study were given in Table 1 to Table 9. Out of the three selected sites, Motichoor is found most polluted area while BHEL Sec 3 is reported least polluted. BHEL Sec 3 area has been considered as Control site in terms of anthropogenic activities round the year.

In year 2021, the total average chlorophyll content in *Mangifera indica* leaves was recorded 4.56 mg/g. The lowest total chlorophyll in case of *Mangifera indica* was recorded 3.78 mg/g at Motichoor study site during the winter season. While

the highest value 5.35 mg/g for the same was noted at BHEL Sec 3 during rainy season.

In the same year of study i.e. 2021, the total average chlorophyll content in *Dalbergia sissoo* leaves

was recorded 2.81mg/g. The lowest total chlorophyll in case of *Dalbergia sissoo* was recorded 1.78 mg/g at Motichoor study site during the winter season. While the highest value 3.82mg/g for the same was noted at BHEL Sec 3 during rainy season.

Table 1: Comparative Study of PM10 at the study sites during 2021

Comparative Study of PM10 at the study sites during 2021			
Months	Motichoor Range	Ranipur More	BHEL Sec 3
JANUARY	188.2	115.2	105.6
FEBRUARY	172.1	118.1	108.2
MARCH	160.5	121.5	111.4
APRIL	165.4	120.4	110.2
MAY	158.2	111.2	101.5
JUNE	118.3	76.3	70.4
JULY	125.6	96.6	86.8
AUGUST	130.8	98.8	90.6
SEPTEMBER	140.5	102.5	95.4
OCTOBER	146.2	106.2	98.1
NOVEMBER	153.4	110.4	102.2
DECEMBER	169.2	112.2	104.2

Table 2: Total Chlorophyll of *Mangifera indica* during the study period (Winter Season 2021)

S.No.	Study Sites	Total Chlorophyll (mg/g)
1	Motichoor	3.78
2	Ranipur More	4.02
3	BHEL Sec 3	4.80

Table 3: Total Chlorophyll of *Mangifera indica* during the study period (Summer Season 2021)

S.No.	Study Sites	Total Chlorophyll (mg/g)
1	Motichoor	4.10
2	Ranipur More	4.68
3	BHEL Sec 3	5.30

Table 4: Total Chlorophyll of *Mangifera indica* during the study period (Rainy Season 2021)

S.No.	Study Sites	Total Chlorophyll (mg/g)
1	Motichoor	4.20
2	Ranipur More	4.85
3	BHEL Sec 3	5.35

Table 5: Total Chlorophyll of *Dalbergia sissoo* during the study period (Winter Season 2021)

S. No.	Study Sites	Total Chlorophyll (mg/g)
1	Motichoor	1.78
2	Ranipur More	2.01
3	BHEL Sec 3	2.85

Table 6: Total Chlorophyll of *Dalbergia sissoo* during the study period (Summer Season 2021)

S.No.	Study Sites	Total Chlorophyll (mg/g)
1	Motichoor	2.52
2	Ranipur More	2.96
3	BHEL Sec 3	3.60

Table 7: Total Chlorophyll of *Dalbergia sissoo* during the study period (Rainy Season 2021)

S.No.	Study Sites	Total Chlorophyll (mg/g)
1	Motichoor	2.65
2	Ranipur More	3.12
3	BHEL Sec 3	3.82

Table 8: Absorption of Light by the leaves of *Mangifera indica* during the study period

Wave length (nm)	Absorption of light %	
	<i>Mangifera indica</i> (Least Polluted Site)	<i>Mangifera indica</i> (Most Polluted Site)
600	25 %	17%
620	32%	22%
640	38%	25%
660	45%	37%
680	75%	60%
700	90%	75%

Table 9: Absorption of Light by the leaves of *Dalbergia sissoo* during the study period

Wave length (nm)	Absorption of light %	
	<i>Dalbergia sissoo</i> (Least Polluted Site)	<i>Dalbergia sissoo</i> (Most Polluted Site)
600	15%	8%
620	18%	13%
640	26%	16%
660	38%	25%
680	60%	40%
700	80%	70%

Less amount of total Chlorophyll content was recorded in the samples from the polluted sites in comparison to control site i.e. BHEL Sec 3. In year 2021, there was a reduction of 29.35 % in the total chlorophyll content in the leaves samples of *Mangifera indica* from polluted site in comparison to control site. In year 2021, there was a reduction of 53.4 % in the total chlorophyll content in the leaves samples of *Dalbergia sissoo* from polluted site in comparison to control site.

The increase in Air pollutants can affect the plant growth. Various types of air pollutants, such as SO₂ and NO_x, affect the metabolic function of the leaves and interfere with net carbon fixation by the plant canopy.

Light is one of the most important environmental factors and plays a critical function in plant development and metabolism. Low absorption of light causes slow growth, decrease of leaf weight and flower bud number. Furthermore, this stress reduces sugar and starch contents in plants species and changes the coloration and extends the maturity time in some floral species.

All types of vegetation use the reaction of photosynthesis to convert light into chemical energy and produce organic molecules. Morphology of leaves, the structure of chloroplasts, content of pigments, diffusion of carbon dioxide, the efficiency of photosynthesis are most common among all of these. But due to the presence of air pollutants, the chlorophyll content got a rapid decrement which ultimately reduces the photosynthesis process through diminishing the absorption of light. During the present study, the similar trend was found, which clearly depict the impact of air pollutants on the light absorption power of the leaves.

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