Vehicular pollution and the common avenue trees of the City of Calcutta - a survey on survival

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Abstract:

Air pollution is a worldwide burning problem and Kolkata is not an exception. The experiment was conducted to observe the effect of traffic derived pollutants on the road side tree lines and human health. The study is based on the analysis, traffic conditions, diversity of plants and the air pollution level of the selected study areas which are Shyambazar to Dunlop, Belgachia to Lake town, Rashbehari to Gariahat and Rabindrasadan to Park Street , some of the busiest vehicular pathway of Kolkata. The biochemical parameters like protein and chlorophyll, microbial study of the phyllosphere , and the effect of wash out of the phyllosphere of selected avenue trees on seed germination were also analysed. Experimental observations showed that the road side plants are subjected to stress due to the traffic derived pollutants and the anthropogenic pressure on the study sites.

Key Words: *Vehicular pollution, Automobiles, Microbial population, Chlorophyll, Protein.*

Introduction

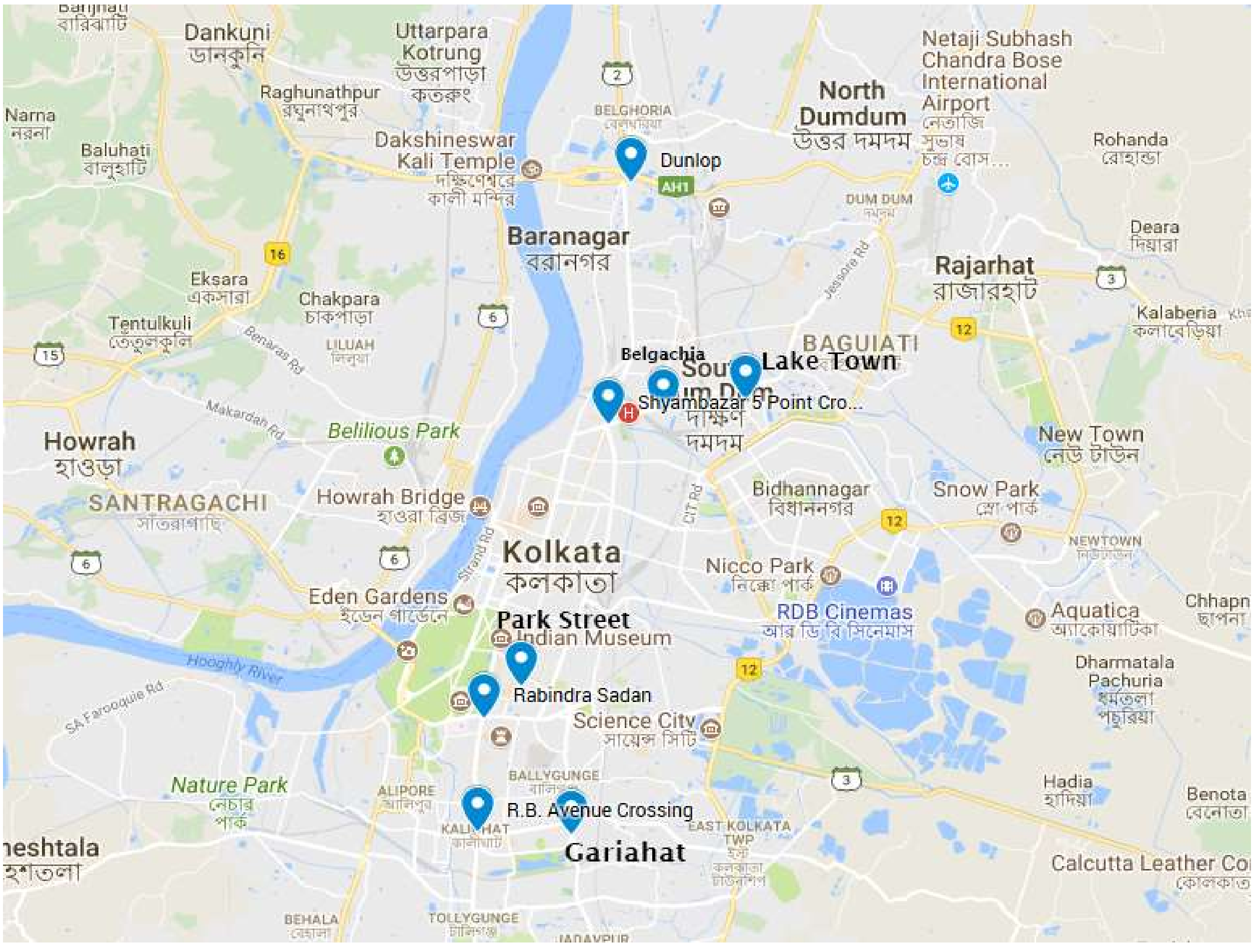
The major source of air pollutants are Vehicles. Carbon dioxide (CO_2), Carbon monoxide (CO) , Sulphur dioxide (SO_2), particulate matter (PM_{10}) all are emitted from automobiles and the level of pollution increases due to the increasing number of vehicles on the roads of a megacity like Kolkata. The vehicular pollution in Kolkata is attributed to a large number of automobiles running daily over only 6% available road space, causing obstruction which brings down the average vehicular speed causing heavy automobile emission *(West Bengal Pollution Control Board, 2010)*. Kolkata with an area of 1480 square kilometre , according to an analysis of *Statista Research Department , March 15 , 2021* exhibits number of registered vehicles across Calcutta which are as follows.

Total transport - 1823836. Two wheeler - 933326 , Private cars - 631786 , Light goods vehicle - 61488 , Auto Rrickshaw - 45415 , Taxi - 34827 , Heavy goods vehicle - 30830 , Public bus – 16550 , Total motor able road: 205 sq. km. is within Corporation Area. The number of vehicles in Kolkata has risen with an annual rate of 4%. Private cars have risen from 0.26 million in 2000 to 0.65 million in 2011, which indicates a 2.5 times increase (Bhaduri, 2013). World health organization published a report in 2002 reveals around 4.6 million people die each year due to the direct influence of air pollution (WHO, 2002). Kolkata is one of the fastest developing megacities in India but the impact of vehicular pollution in this city is highly alarming. .Trees may absorb some pollutants in the natural life processes common to all plants. In realising of gases, plants take carbon dioxide to make food, and release oxygen. This gaseous exchange takes place through stomata or pores on the leaves surface. Chlorophyll is the essential components for plants and with the help of chlorophyll plants make their own food in the presence of sunlight and CO_2, water. Changes of leaf chlorophyll are relative markers of environmental pollution (Carter and Knapp , 2001). The main roads of Kolkata with heavy traffic are seen with the plantation of avenue trees with greater capacity to build canopies. These are planted to have aesthetic beauty and also in connection with the reduction of air pollution. In this study we have observed the diversity of planted plants along the roadside of four busiest area of Kolkata , which are Shyambazar to Dunlop, Belgachia to Lake town, Rashbehari to Gariahat and Rabindrasadan to Park Street. The objective of the study was to examine the effect of pollutants which are derived from the automobiles on trees and the diversity in the distribution of trees, the biochemical parameters of leaves of the selected plants due to the effect of traffic pollutants, to examine the air pollutant levels and phyllospheric microbial population study.

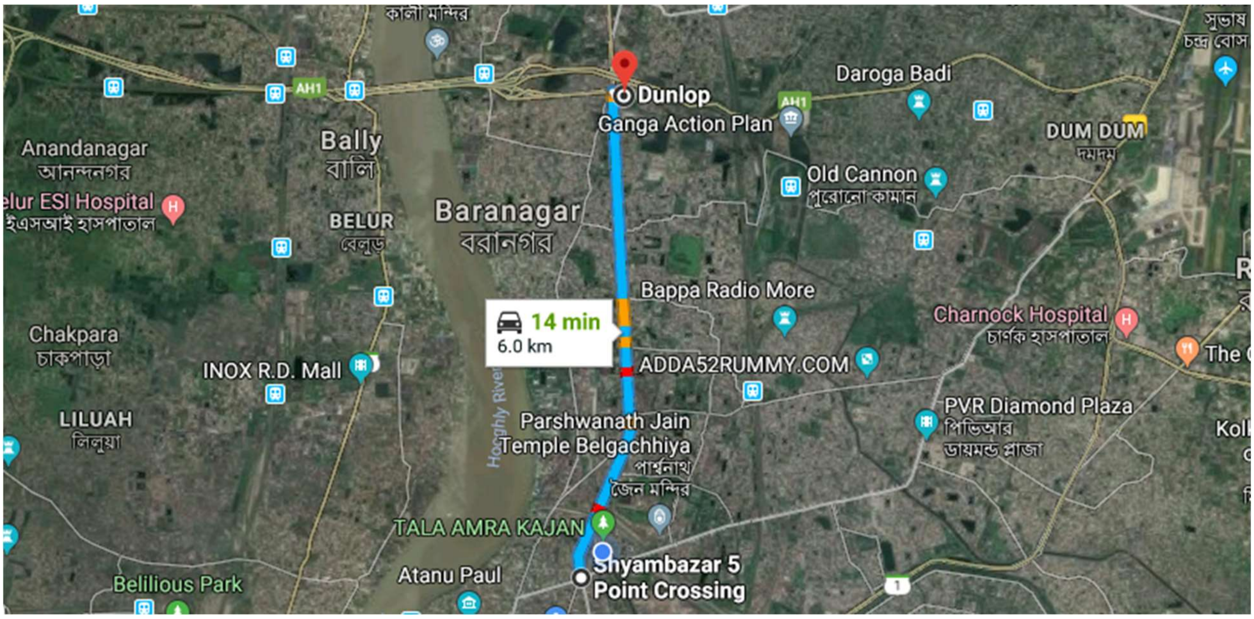
Materials and Methods:

Selection of roads and location and description

The study was conducted at four locations in Kolkata which are – (1) Shyambazar to Dunlop (2) Belgachia to Lake Town (3) Rashbehari to Gariahat (4) Rabindrasadan to Park Street. These locations were selected due to the heavy number of vehicles flowing through the study area and to examine the impact of pollutants which are derived from the automobiles on the avenue trees. Shyambazar is a neighbourhood of north Kolkata. BT road (Barrack pore Trunk Road) is a four lane road connecting Shyambazar to Barrack pore. It starts from Shyambazar five point crossing and end at Barrack pore. Dunlop crossing is one of the busiest crossing in Kolkata Belgachia and Lake Town are the neighbourhood of North Kolkata. Lake town comes under the jurisdiction of South Dumdum Municipality in Barrack pore subdivision in North 24 Pargana district . Park street is a famous thoroughfare in the city of Kolkata and Rabindra sadan is a cultural centre in Kolkata . Rashbehari avenue is one of the most prestigious and important east west avenues of Kolkata . A major portion of this road is often commonly referred to as Gariahat , the prime shopping and aristocratic residential neighbourhood of South Kolkata . Rashbehari crossing is the busiest crossing in Kolkata . The distance between Shyambazar to Dunlop is 8 kms. Belgachia to Lake Town is 2 km. Rashbehari to Gariahat is 2 km and Rabindrasadan to Park Street is 1 km respectively that has been covered as study location.

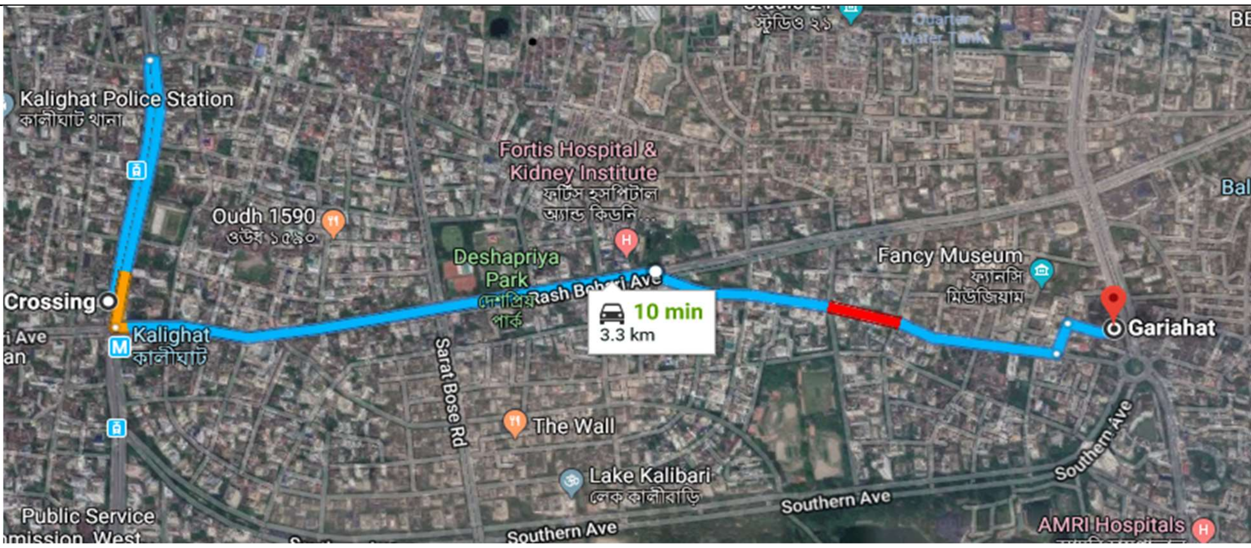


Location of the study areas in Kolkata

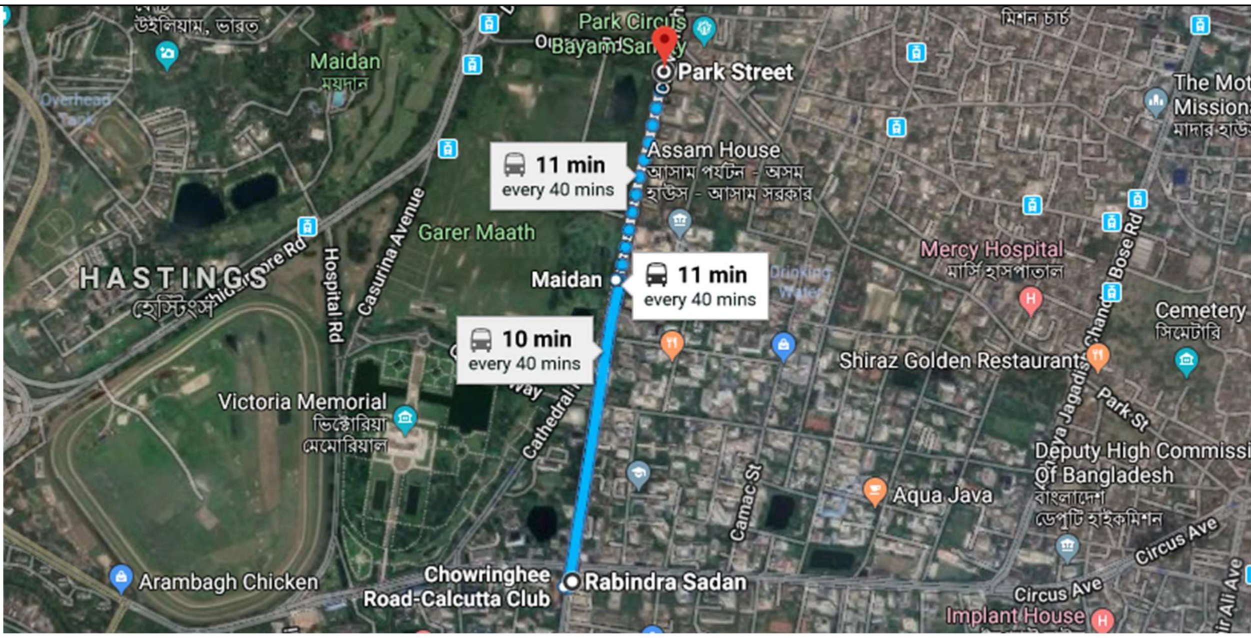


Shyambazar to Dunlop

Belgachia to Lake town



Rashbehari to Gariahat



Rabindra Sadan to Park Street

Estimation of Traffic data

Traffic data was taken from the selected study area. The number of small and large vehicles was measured for the 3 consecutive hours with an interval of 2 hour. Based on this data the number of small and large vehicles flowing per day per week and per month through these location sites were also calculated.

Estimation of air pollution level on the study area (SO_2, NO_2, $PM_{2.5}$, PM_{10})

The data was collected from the website of West Bengal Pollution control board (WBPCB, 2010) by the following way – Website of WBPCB→ air quality index → automatic station →select the station name (for each study area) →input the data.

Floral study

The diversity of the trees was counted manually at the four location sites and a checklist of plant species was also prepared. The number of trees of each study area were also calculated by transect method.

Methodology for biochemical parameters

Estimation of chlorophyll

The chlorophyll a, b in the leaves of ***Mangifera indica, Ficus religiosa , Polyalthia longifolia, Alstonia scholaris , Psidium guajava*** were estimated. 2 gm of fresh leaves with excess of 80 % acetone in a mortar with pestle was homogenized using neutral sand. The supernatant was filtered through a Buchner funnel using What man No 42 filter paper. The extraction was repeated with sufficient quantity of 80% acetone. The content was transferred from mortar to the Buchner funnel and washed with 80% acetone until it appeared colourless. The filtrate was poured and made the volume up to 50ml with 80% acetone. The absorbance **(A)** of this diluted extract was measured by 645 and 663 nm for the determination of chlorophyll a and b **[Lichtenthaler et al., 1983]**

Chlorophyll (a) (mg gm^{-1})

$$= \frac{12.7A_{663} - 2.69A_{645}}{100 * W} * V$$

Chlorophyll (b) (mg gm^{-1})

$$= \frac{22.9A_{645} - 4.68A_{663}}{1000 * W} * V$$

Where V= Volume of extract in ml

W= Fresh weight of the leaf sample in grams

Estimation of protein

The leaf protein of ***Mangifera indica, Ficus religiosa , Polyalthia longifolia, Alstonia scholaris , Psidium guajava*** were estimated . 2ml of leaf extract was collected and 2ml of ethyl alcohol was added to it and was mixed properly. It was filtered with filter paper and from this filtrate 1 ml of sample was collected . 3ml of Lowry reagent was added. Then it was incubated for 15 minutes. 0.5 ml of Folin phenol reagent was added and it was kept in dark for 30 minutes. The absorbance of this sample was measured by 595 nm for the estimation of the protein. **(Lowry et al., 1951)**

Methodology for the study of microbes

Collection of plant leaves and estimation of microbes by serial dilution

The water was collected by washing the leaf lets of the selected plants from four different study areas and it was poured into four seperate sterilized containers. Initial dilution was prepared by adding 0.1 ml of water sample into 9.9 ml dilution blank labelled as 10^{-1}. Thus dilution was made from the original sample for 10 times. The content was vortexed to obtain the uniform distribution of the organisms. From the 1st dilution 0.1 ml of suspension was transformed to the dilution blank of 10^{-2} with pipette , thus diluting the sample 100 times from that of the original . The vortex was repeated unless the original sample had been diluted 10,000,000 times (10^{-7}) every time using a sterile pipette (Conventional method).

Spread plate method

1 ml of sample each from 10^{-3} dilution to 10^{-7} dilution was transferred to the solidified agar plates. Plates were labelled according to the study area for each dilution. With the help of the sterile glass spreader the sample was uniformly spread all over the surface of the solidifying agar medium. After addition of water suspension the plates were kept in an inverted position at 37^{0}C for 24- 48 hours in an incubator (Conventional method).

Gram staining method

Glass slides were washed and dried. A smear of bacterial culture was prepared. The smear was air dried and fixed carefully. The slide was kept on flat surface and it as covered with crystal violet for 2 minutes. The excess stain was decanted off and washed with distilled water. Gram iodine was then added to the smear and allowed to stand for 2 minute. The iodine was washed with 95% ethyl alcohol. The smear was counter stained with Safranin for 1 minute. The slide was carefully washed with distilled water and blotted. The slide was examined under the microscope and the cell morphology was observed **(Aneja, 2007)**.

Methodology for seed germination

Five plates were labelled for each site according to the study area and for control. The water was collected by washing the surface of leaflet of the selected plant species and it was poured into 4 different containers. 10 fresh viable seeds of ***Vigna radiata* and *Cicer arientinum*** were taken on the labelled petriplate over blotting paper and 2ml of distilled water that was collected from the leaf surface from four selected sites was given in each plate to obtain the germination result with a control set of seeds under plain water. The plates were incubated in 25^{0}C for one day and the same process was repeated in the next two days to observe the result. **(Bhattacharyya et. al . 2014)**.

Results and Discussion

The Google maps of the four study location were presented. (Location map 1-4) These helped to know the locations clearly. On the other hand the air pollution level in some of the megacities of India were presented and tallied with highest air pollution level in Kolkata. **Fig, 1**.

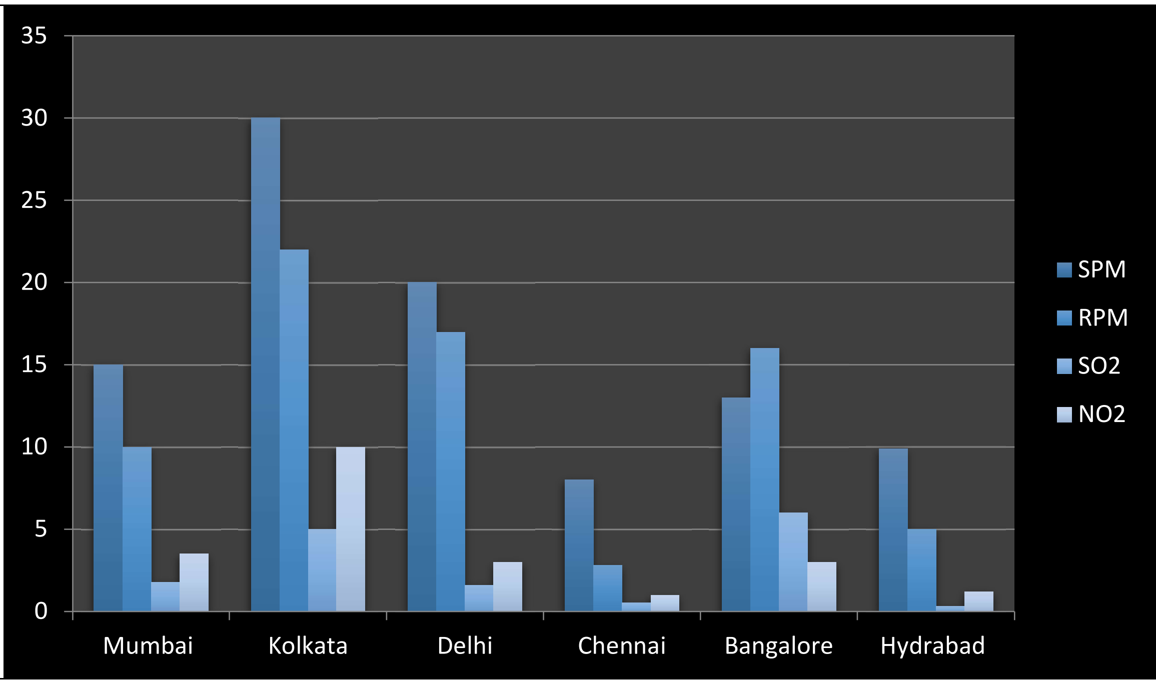


Fig. 1. Showed the air pollution level in the megacities of India. Source (Ministry of petroleum and natural gas , 2018

The air quality at Shyambazar to Dunlop, Belgachia to Lake town , Rashbehari to Gariahat showed the concentrations of the particulate matter highest in comparison to SO_2 and NO_2 concentrations and the concentrations of NO_2 remained high as compared to the SO_2 concentrations in all study areas. **Table 1 – 6.**

Pollutant	**Concentration (µg/m^3)**	**Sub Index**
SO_2	6.83	9
$P.M_{2.5}$	83.00	177
NO_2	46.33	58
$P.M_{10}$	160.33	140

Table 1: Air quality Index for Shyambazar (WBPCB, 10th March, 2018)

Pollutant	**Concentration (µg/m^3)**	**Sub Index**
SO_2	9.00	11
NO_2	47.33	60
$P.M_{10}$	191.33	161

Table 2: Air Quality Index for Dunlop (WBPCB, 10th March, 2018)

Pollutant	Concentration (µg/m^3)	Sub Index
SO_2	4.17	4.17
$P.M_{2.5}$	72.00	72.00
NO_2	36.50	36.50
$P.M_{10}$	141.67	141.67

Table 3: Air Quality Index for Belgachia (WBPCB, 15th March, 2018)

Pollutant	Concentration (µg/m^3)	Sub Index
SO_2	3.33	4
NO_2	36.17	45
$P.M_{10}$	120.33	114

Table 4: Air Quality Index for Gariahat (WBPCB, 5th April, 2018)

Pollutant	Concentration (µg/m^3)	Sub index
SO_2	4.00	5
$P.M_{2.5}$	50.00	83
NO_2	31.17	39
$P.M_{10}$	95.00	95

Table 5: Air Quality Index for Rabindrasadan (WBPCB, 6th April, 2018)

AQI	Remark	Air Quality Index Health Impact
0-50	Good	Minimal impact
51-100	Satisfactory	Minor Breathing Discomfort to sensitive People
101-200	Moderate	Minor Breathing Discomfort to People with Lung and Heart Disease
201-300	Poor	Breathing Discomfort to People with Lung and Heart Disease Children and Adults
301-400	Very Poor	Respiratory Illness of People on Prolonged Exposure
>400	Severe	Respiratory Effects even on Healthy People

Table 6: Air Quality Index Health Impact (WBPCB , 17th July,2018)

The data on vehicular emission clearly deals with the increasing population pressure, insufficient road space, vehicles with the age 15 years or above , congestion of slow moving vehicles in Kolkata which adds to its misery. The thick air is inhaled by the city's walker and the traffic polices are the worst sufferer. The West Bengal Pollution Control Board (WBPCB) provided us detailed information regarding the air pollution level of selected sites of the city from the month of **March to April , 2018**. This data showed that there is a great intensity of air pollution at these selected sites. **Table 1 – 6.**

The number of small and large vehicles along the road of the study areas were presented in Table and in Graphical representation which showed maximum number vehicles passes through the Shyambazar to Dunlop followed by Rabindra sadan to Park street , Rashbehari to Gariahat and Belgachia to Lake Town both for small and Large vehicles. So , it can be easily estimated the level of air pollution from the vehicular emission in this area. This observation helped us to correlate the pollution strata of those areas which are faced by the avenue trees along side of these roads. **Fig. 2** showed the average density of vehicles flowing (a) per hour (b) per day (c) per week (d) per month in the study area A = Shyambazar to Dunlop B = Belgachia to LakeTown C = Rashbehari to Gariahat D = Rabindrasadan to Park Street. And **Table 7** showed a sum up of the data that are presented in **Figure 2**.

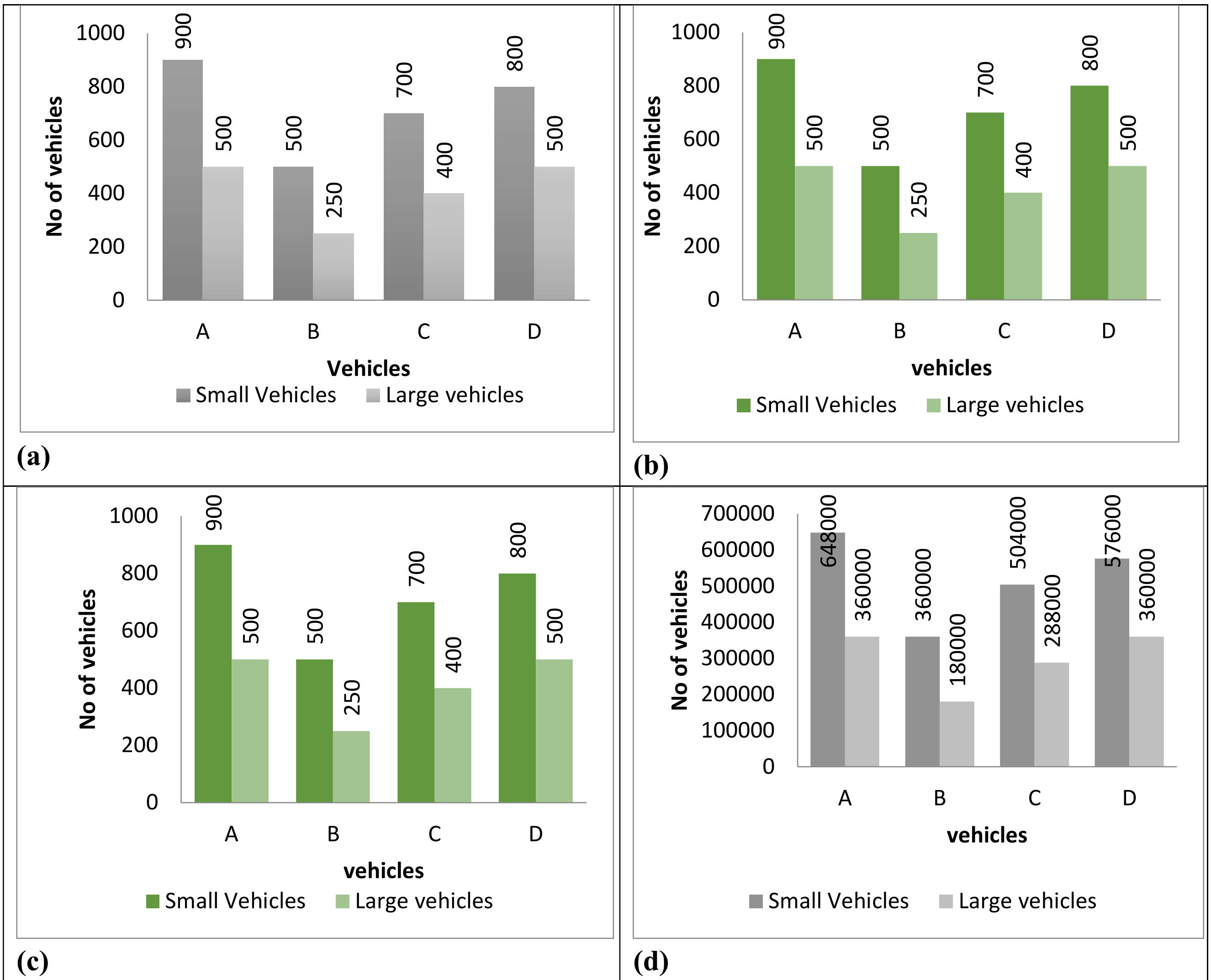


Fig 2 : The average density of vehicles flowing (a) per hour (b) per day (c) per week (d) per month in the study area. Locations are : (a) Shyambazar to Dunlop; (b) Belgachia to LakeTown; (c) Rashbehari to Gariahat; (d) Rabindrasadan to Park Street

Study area	No of small vehicles flowing				No of large vehicles flowing			
	per hour	per day	per week	per month	per hour	per day	per week	per month
Shyambazar to Dunlop	900	21600	157200	648000	500	12000	84000	360000
Belgachia to Laketown	500	12000	84000	360000	250	6000	42000	180000
Rashbehari to Gariahat	700	16800	117600	504000	400	9600	67200	288000
Rabindrasadan to Parkstreet	800	19200	134400	576000	500	12000	84000	360000

Table 7 showed the number of small and large vehicles in the study area per hour / day / week / month

The total number of the plant species on the both sides of avenues are 120, 65, 85 and 78 in Shyambazar to Dunlop (***location 1***) , Belgachia to Lake town (***location 2***) , Rashbehari to Gariahat (***location 3***) and Rabindrasadan to Parkstreet ***(location 4*****).** The average distance of the roadside trees from one to another is 11.43 meters in ***location 1***, 9.14 meters in ***location 2*** and ***3*** .In ***location 4*** it is 6.85 meters approximately. The distance between the plant keeps proportionality with the total number of plants along the road of the locations. In the Table No. And we have included the 11 most abundant plant species that are observed in the four study area and also described some of their morphological facts along with scientific names and families. Unfortunately the condition of these recorded plants alongside the pavement of these study areas are poor in terms of the plant health **(Table 8 – 9).**

Name of the plant species	Location1	Location2	Location3	Location4
Banyan tree	+	-	+	+
Mango tree	-	-	+	+
Peepal tree	+	+	+	+
Deodar tree	+	+	+	+
Gregarious tree	-	-	-	+
Chatim tree	+	-	+	+
Peacock flower	+	+	+	+
Jarul tree	-	-	-	+
Guava tree	+	+	-	+
Jack fruit	-	+	-	+
Palash tree	+	-	-	+

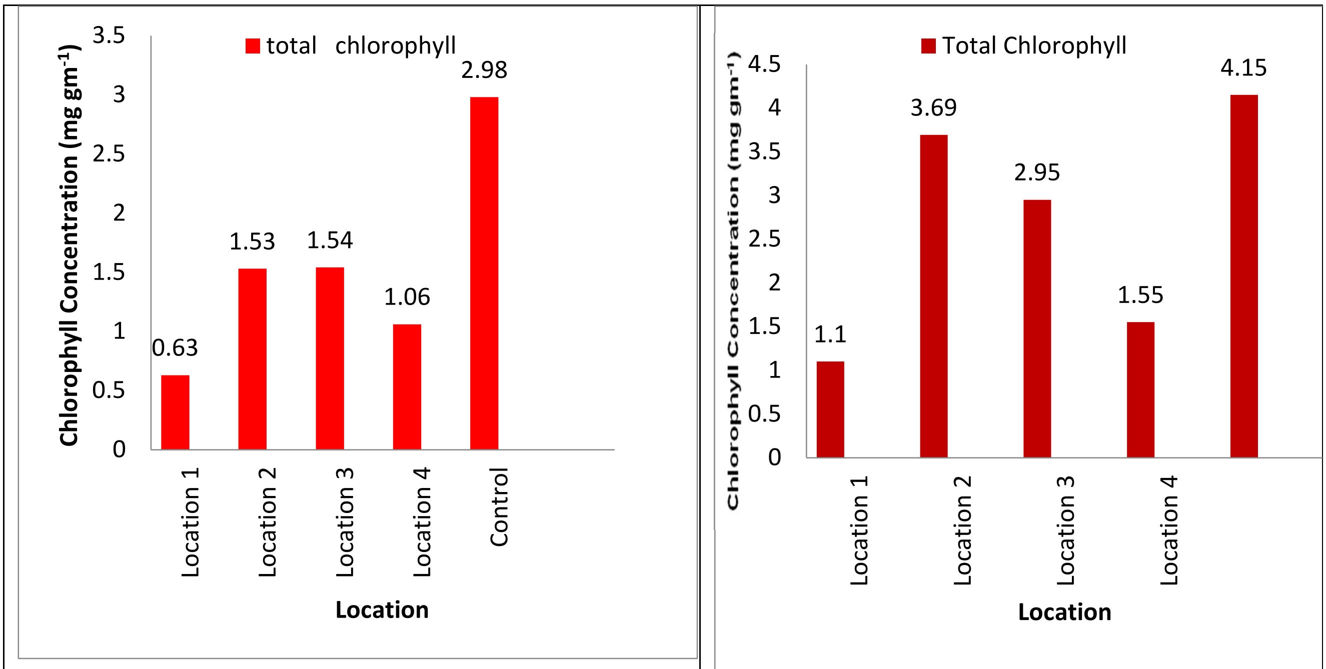
Table 8. showed the abundance of 11 plant species on the selected study area

Common name	Scientific name + APTI	Family	Essential Description
1. Mango	***Mangifera indica* + 18.5**	Anacardiceae	Large evergreen , 10-45 m in height, dome shaped with dense foliage , spirally arranged leaves are large.
2.Peepal	***Ficus religiosa* 7.68**	Moraceae	Large dry season-deciduous or semi-evergreen tree up to 98 ft tall , The leaves are cordate in shape with a distinctive extended drip tip; they are 10–17 cm long and 8–12 cm broad, with a 6– 10 cm petiole.
3.Guava	***Psidium guajava* 6.43**	Myrtaceae	Evergreen shrub or small tree, up to 10 m high.. The leaves are opposite and simple, ovate to oblong-elliptic, rounded at the base,
4.Chatim	***Alstonia scholaris* 13.45**	Apocynaceae	Glabrous tree and grows up to 130 ft. tall. The upper side of the leaves is glossy, while the underside is greyish. Leaves occur in whorls of three to ten; The leathery leaves are narrowly obovate to very narrowly spathulate,
5. Peacock flower	***Caesalpinia pulcherinna* 16.48**	Fabaceae	The tree can rise upto 25m and its low branches form an open and spreading bush. It is a shrub growing to 3 m tall. The leaves are bipinnate, 20–40 cm long, bearing 3-10 pairs of pinnae, each with 6-10 pairs of leaflets 15–25 mm long and 10–15 mm broad.
6. Deodar	***Polyalthia longifolia* 16.66**	Annonaceae	Evergreen tree can grow up to a height of 15-20 meters tall , The longest branch is seen at the base and shorter at the end of the trunk, giving an appearance of conical crown. Leaves are long, narrow dark green and glossy. Leaf blades are ovate-oblong to ovate-lanceolate with wavy margins.
7.Gregarious	***Dalbergia sissoo* 10.669**	Leguminosae	Medium to large deciduous tree with a light crown . It can grow up to a maximum of 25 m (82 ft) in height . Leaves are leathery, alternate, pinnately compound and about 15 cm (5.9 in) long.
8. Jarul	***Lagerstroemia flosreginae* 8.87**	Lythraceae	Shrub to large tree with multiple trunks or stems diverging from just above ground level, up to 40(45) m tall and 100(-150) cm in diameter. Leaves opposite, distichous, simple, entire, stipules minute or absent.
9.Palash	***Butea monosperma* 10.3**	Fabaceae	An erect tree with height of 12-15 m and irregular branches bark rough, ash coloured, and young parts downy. The Leaves of plant are 3-foliate, with 10-15 cm long,
10. Silk cotton plant	***Bombax ceiba* 35.46**	Moraceae	Deciduous trees; to 45 m high , ; branches horizontal and more or less whorled; branchlets prickly. Leaves digitately-compound, alternate.
11.Banyan tree	***Ficus benghalensis* 21.65**	Moraceae	Large, long-lived, fast-growing evergreen tree up to 20 -25 m, tall. It has a wide leafy crown of horizontal branches covering up to 100 m around , The leaves are large, 8-25 cm long x 6-20 cm broad, stoutly petiolated. The lamina is coriaceous, nerved, ovate to obovate in shape. The lamina is glabrous on the upper face and finely pubescent.

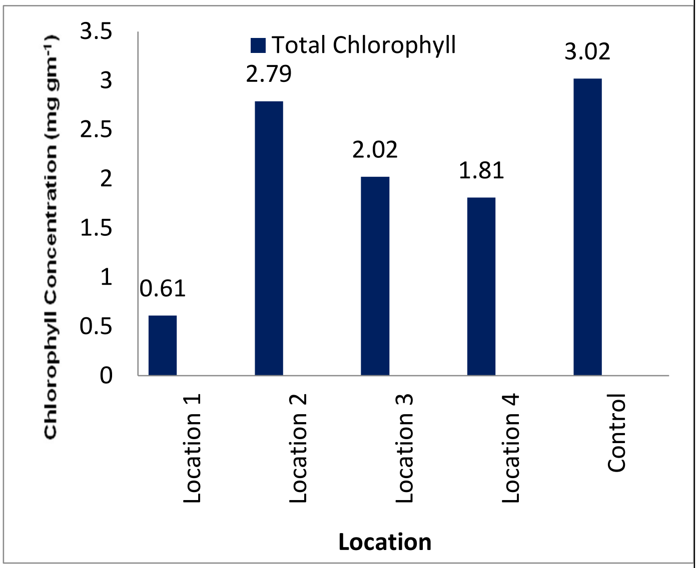
Table 9. The morphological features of the plant species with Air pollution tolerance index (APTI) value.

Air pollution tolerant index is an index, which regulates the potentiality of a plant to compete against air pollution. Plants which have higher index value are tolerant to air pollution and can be used as sink to reduce pollution, while plants having low index value show slighter tolerance and can be used to indicate levels of air pollution. *Ficus religiosa* , *Ficus bengalensis* and *Mangifera indica* have high APTI value (Haque, 2017) . The plant species, which are grown up along the road sides and are commercially important, may show as an absorbent of the various pollutants and their study may give the level of pollutants in any specific area of interest Similarly, species with higher APTI should be planted in the areas (Singh, 1983)

High traffic load donates high dust fall on the plant leaves this also depends upon the situation of roads (Lone, 2005) and size and structure of leaves. Maximum decrease in chlorophyll content recorded in location 1 plant species and lowest decrease in chlorophyll recorded in plant species of the location 2 . Reduction of chlorophyll may happen due to the increase of chlorophyllase enzyme activities, which in turn influence the chlorophyll concentration in plants (Mandal et. al., 2000). SO_2 plays an major role in the reduction of chlorophyll content which causes phenopythin formation by acidification of chlorophyll (Mandloi et al., 1988). Reductions in chlorophyll contents of a variety of crop plants due to SO_2 and O_3 exposure have also been reported by Agrawal (Agarwal, 1985). Chlorophyll content is essential for the photosynthetic activity and reduction in chlorophyll content has been used as an indicator of air pollution stress. **Figure 3** showed the chlorophyll a and Chlorophyll b concentration of **(a)** ***Mangifera indica*****,(b)** ***Ficus religiosa*****,(c)** ***Polyalthia guajava*** **(d)** ***Alstonia scholaris*** **(e)** ***Psidium guajava***



(a) **(b)**



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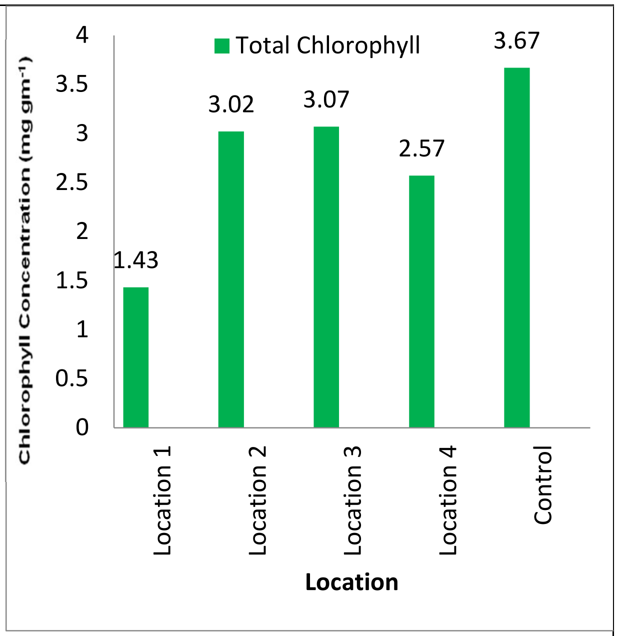

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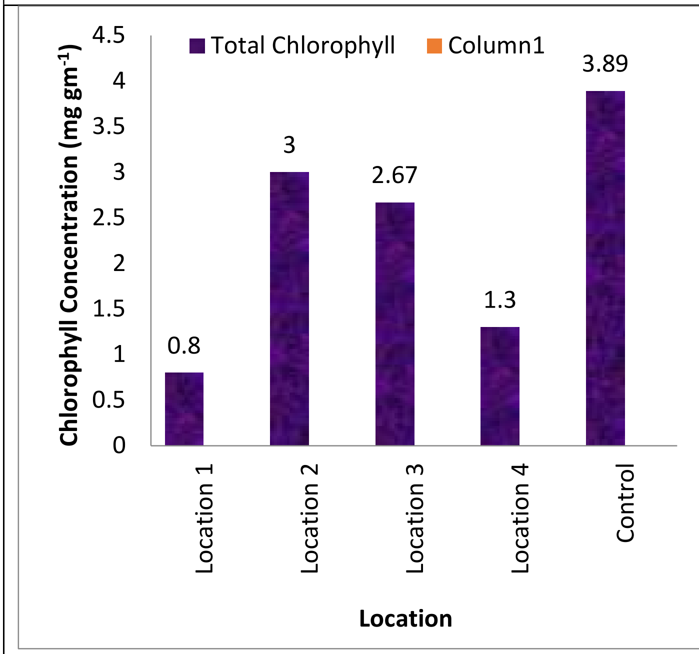
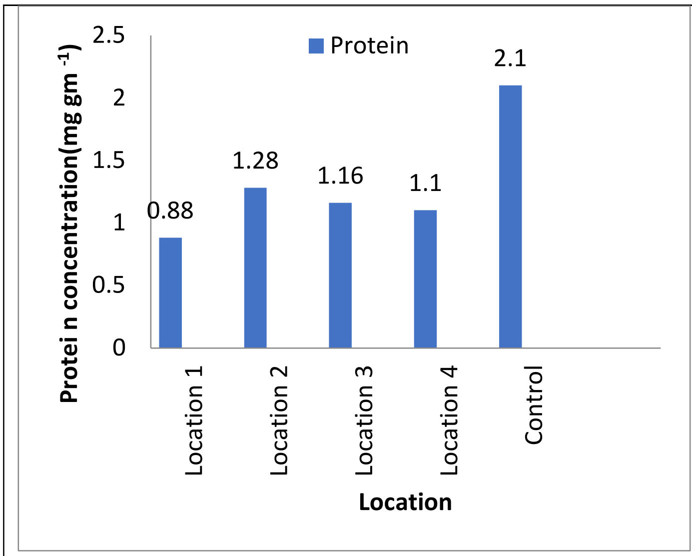


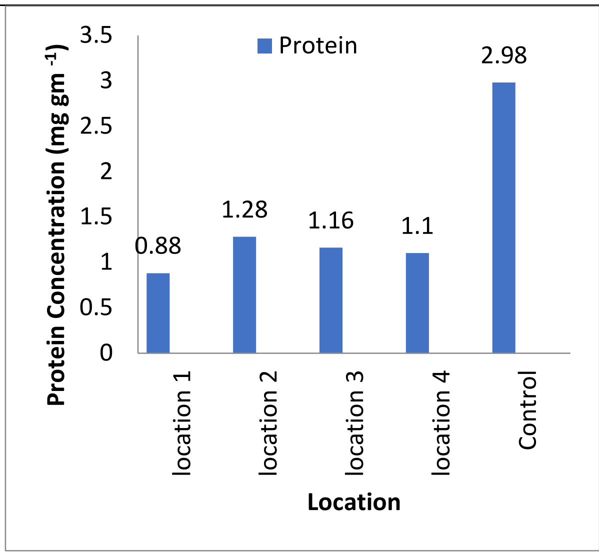
(e)

Fig 3: Total chlorophyll concentration of (a) ***Mangifera indica***,(b) ***Ficus religiosa***,(c) ***Polyalthia longifolia*** (d) ***Alstonia scholaris*** (e) ***Psidium guajava*** available at
Location 1= Shyambazar to Dunlop
Location 2= Belgachia to Lake town
Location 3= Rashbehari to Gariahat.
Location 4= Rabindrasadan to Park Street

Maximum loss of leaf protein was recorded in plant species from location 1 and minimum loss was found in the plant species of location 2. **Figure 4** showed the protein concentration of **(a) *Mangifera indica*,(b) *Ficus religiosa*,(c) *Polyalthia guajava* (d) *Alstonia scholaris* (e) *Psidium guajava***. The protein loss may be due to the effect of automobile emission on plant leaf which absorbs most of the pollutants. Reduction in soluble protein and chlorophyll contents in a few plants as indicators of automobile exhaust pollution (Banerjee et. al. 2007).



(a)



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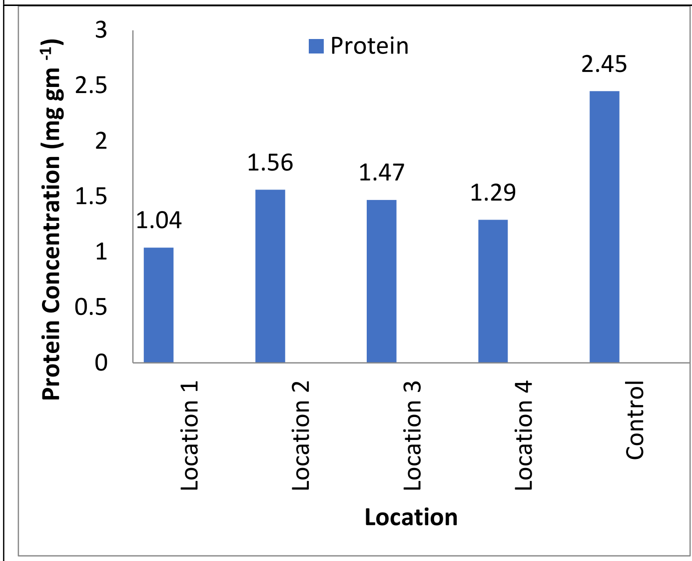

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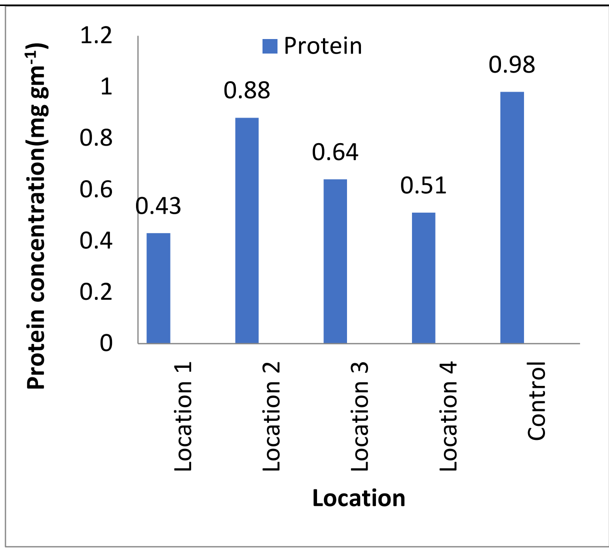

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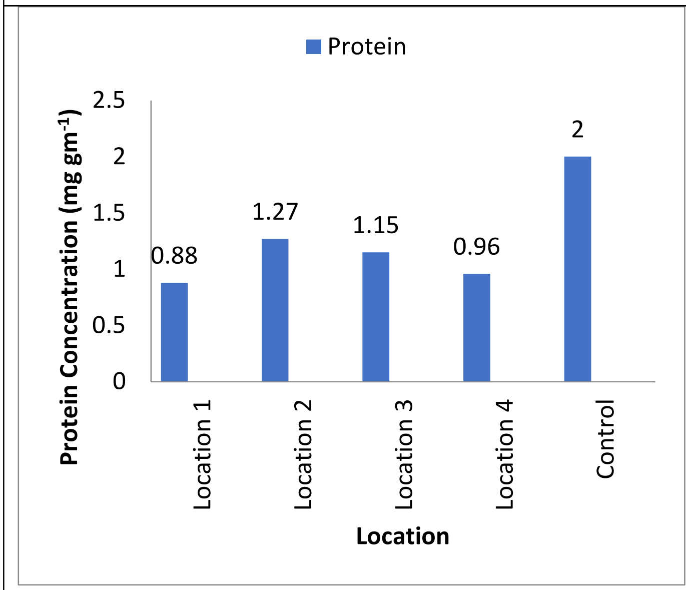


(e)

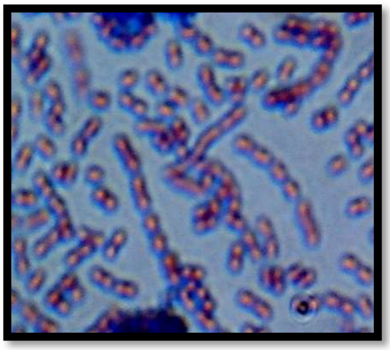
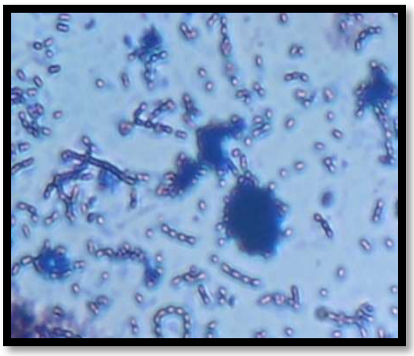
Fig 4: Protein concentration of (a) ***Mangifera indica*,**(b) ***Ficus religiosa*,**(c) ***Polyalthia longifolia*** (d) ***Alstonia scholaris*** (e) ***Psidium guajava***
Location 1= Shyambazar to Dunlop
Location2= Belgachia to Lake town
Location 3= Rashbehari to Gariahat.
Location 4= Rabindrasadan to Park Street

The plates were observed after the 2 days of incubation for appearance of colonies over the agar surface. The *Azotobacter* colonies appear flat soft mucoid and milky which are N_2 fixing bacteria and the starch degrading bacteria were found in the four location sites. The plates were examined for the starch hydrolysis around the line of growth of the organisms. Typical positive starch hydrolysis reaction surroundings the microbial colonies were shown by the production of exoenzyme amylase which was diffused into the medium surrounding growth. Phosphate solubilising bacteria was also found on the location 1 and 4. **Bacterial count on phyllosphere: Table 10.** The number of bacterial colonies in agar medium is maximum at shyambazar to Dunlop area (location1) where as the number of colonies is minimum in the Belgachia to Laketown (location 2). It may be for the turbulence of air at location 1, the bacterial count showed maximum population. .

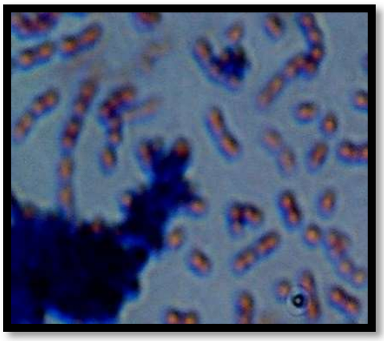
Water collected from the leaves surface of the study area	Dilution	Medium	Colony count after 24 hours	Colony count after 72 hours
Shyambazar to Dunlop (location1)	10^{-3}	Nutrient agar	203	300
	10^{-4}	Nutrient agar	179	252
	10^{-5}	Nutrient agar	77	168
Belgachia to Lake town (location 2)	10^{-3}	Nutrient agar	170	200
	10^{-4}	Nutrient agar	160	184
	10^{-5}	Nutrient agar	122	165
Rashbehari to Gariahat (location 3)	10^{-3}	Nutrient agar	188	272
	10^{-4}	Nutrient agar	150	228
	10^{-5}	Nutrient agar	116	212
Rabindrasadan to Park street (location4)	10^{-3}	Nutrient agar	186	262
	10^{-4}	Nutrient agar	135	220
	10^{-5}	Nutrient agar	112	198

Table 10: Showed the results of the number of microbes on each study area

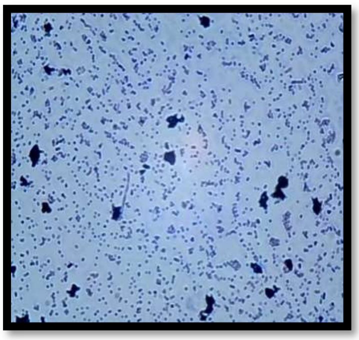
Bacterial association was evident by microscopy on the phyllosphere of selected plant species of heavily vehicular polluted zone, which indicated its sensitivity to the dust as well as microbial population adheres on the surface of the leaves on dust. . Stomata generally act as a direct passage for water transportation. Covering of stomata with dust causes the disturbance in the transpirational processes. An extensive and further research is needed in this area to describe the proper mechanism of the interaction of air pollutants and microbial association.

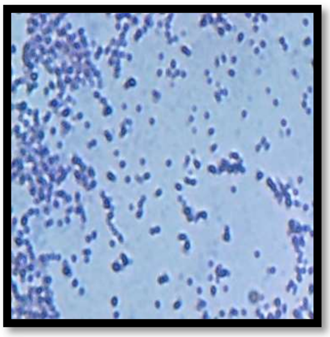
Location 1



Location 2



Location 3



Location 4

Photographs of Bacterial populations in phyllosphere of plant species of Location 1 - 4

Highest number of seeds were germinated by the leaf water leachates of location 2 (Belgachia to Lake town) and the lowest seed were germinated in location 1 (Shyambazar to Dunlop). This indicates the extreme presence of leaf surface pollutants in location 2 in comparison to the location 1. **Table 11** showed the percentage of inhibition of the seed germinated on each location of the study area.

	1st DAY		2nd DAY		3rd DAY	
	Cicer	*Vigna*	*Cicer*	*Vigna*	*Cicer*	*Vigna*
Control	10	10	10	10	10	10
Shyambazar to Dunlop	4	5	5	5	5	5
Belgachia to Laketown	6	5	7	5	7	5
Rashbehari to Gariahat	5	4	5	4	5	5
Rabindrasadan to Parkstreet	7	5	7	6	7	6

Table 11. Showing the germination of seeds of *Cicer* (Gram) and *Vigna (* mung) by number in comparison to control. The seeds were treated by wash out water of the leaf surface of the randomly selected plant from 4 study areas. The control seeds were treated by the wash out of the leaves of plant collected from Bhadreswar , Hooghly , a rural area. The seeds were incubated for three days in an incubator (27 degree celcius)

Conclusion

We live in an age of vehicles. Vehicles have raised our potency, increased our efficiency and have added to a substantial loss of the cost in transition also by saving time. However , increase in vehicular population has its adverse effect. The emission from vehicles has degrade our environment. Of course, the faulty road structure and congestion have complicated the issue. The increase in number of vehicles and the impact of their emission have direct effect on the avenue plants which suffer from toxicity as induced by air pollutants. The phyllospheric study of the plants , the condition of the road side plants under continuous emission , their detrimental change on the primary metabolites are to be seriously discussed. The health , growth and development of road side plants which may absorb a considerable amount of air pollution are at a stake in the city of Calcutta. The concept of clean and Green city may get interruption when our study showed the actual situation.

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