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Original Article

STUDIES ON SOIL NUTRIENT, BIOMARKER POTENTIAL OF PLANTS COLLECTED NEAR INDIAN OIL GAS PLANT

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ABSTRACT

The air pollution tolerance index was studied for *Ficus religiosa, Millettia pinnatta, Psidium guajava*, *Eucalyptus tereticornis*, *Tamarindus indica, Azadirachta indica, Santalum album*, *Casuarina equisetifolia*, *Annona squamosa*, Cicca acida, *Wrightia tinctoria*, *Atrocarpous heterophyllus*, *Polyalthia longifolia*, *Ficus benghalensis* that were present in the selected spot. The soil samples from the study area was also assessed for its nutrients. The 15 plants selected for the study showed APTI values below 16 and thud classed under sensitive plants. The sensitivity might be due to seasonal variations and climatic conditions. The soil nutrients supplying essential factors for growth showed normal potassium and nitrogen content. Total mineral content noticed was 281.78kg/acre.

Key words: Air, Pollution, Index, Minerals, Plants.

INTRODUCTION

The plants were selected near Indian Oil Gas Plant located at Karupur, Panangadu, Salem, Tamil Nadu, India. Only 4 buses, 100 lorries, 100 bikes, 50 cycles were in that road. But very close to that within 1 Km distance Bangalore NH road busy with huge number of vehicles was present. Approximately 40,000 two wheeler, 30,000 car, lorry 25,000, 7500 buses, auto 400, 150 travel vehicles were migrating in that road. Totally 15 plants were selected for the study. The approximate number of plants available in the particular location is given as follows: *Tectona grandis(27), Ficus religiosa(10), Millettia pinnata*(15), *Psidium guajava*(10), *Eucalyptus tereticornis*(5), *Tamarindus indica(3), Azadirachta indica(20), Santalum album*(15), *Casuarina equisetifolia*(20), *Annona squamosa*(30), *Cicca acida*(25), *Wrightia tinctoria*(35), *Artocarpus heterophyllus*(10), *Polyalthia longifolia*(3), *Ficus benghalensis*(10). From the plants collected, the air pollution tolerance level, soil nutrients present in the particular location was also studied.

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MATERIALS AND METHODS

Leaf sample collection

For the present study, fresh leaves from each plant was collected from the experimental site near Indian Oil Gas Plant located at Karupur-Panangadu, Salem, Tamil Nadu, India during the month of December, 2014. Common plants identified were selected from the study areas. All the selected plants were identified by Dr. A. Balasubramanian, as well as by comparing with book named Dictionary of Medicinal Plants written by Dr. A. Balasubramanian, Executive Director, ABS Botanical garden, Salem, Tamil Nadu, India.

Extract preparation

Fresh leaves were used according to the standard prescribed methods adopted. Aqueous extract was used for the whole study.

Soil sample collection

The soil samples were collected from the study areas at a depth of 10-15cm. The collected soil samples were removed and freed from debris, stones and then sieved. The sieved samples (500gm) was packed and sealed in an airtight plastic cover and sent for nutrient analysis.

BIOCHEMICAL PARAMETERS

pH

100 mg of the fresh leaves was homogenized in 10ml deionized water. This was filtered and the pH of the leaf extract was determined after calibrating pH meter with buffer solution pH 4 and pH 9.

Relative water content

Fresh weight was obtained by weighing the leaves. The leaf samples were then immersed in water over night blotted dry and then weighed to get the turgid weight. The leaves were then dried overnight in a hot air oven at 70^0c and reweighed to obtain the dry weight. RWC was determined and calculated by the method as described by Singh 1977.[1]

RWC=[(FW-DW)/(TW-DW)] x 100.

Where: FW-Fresh weight,DW-Dry and TW-Turgid weight

Ascorbic acid content

Ascorbic acid content was measured by Titrimetric method of Sadasivam 1987[2] using 2, 6, Dichlorophenol indo phenol dye. 500mg of leaf sample was extracted with 4% oxalic acid and then titrated against the dye until pink color develops. Similarly a blank is also developed.

Total chlorophyll content

For Total chlorophyll analysis, 0.5g fresh leaves material was grounded and diluted to 10ml in distilled water. A subsample of 2.5ml was mixed with 10ml acetone and filtered. Optical density was read at 645 nm (D645) and 663 nm (D663).[3] Optical density of TCh (CT) is the sum of chlorophyll a (D645) density and chlorophyll b (D663) density

as follows: CT = 20.2 (D645) + 8.02 (D663), TCh (mg/g DW) was calculated as follows: TCh = 0.1CT x (leaf DW/leaf fresh weight).

Calculation of APTI

The air pollution tolerance indices of the selected plants were determined by following the method of Singh and Rao.[4] The formula of APTI is given as: APTI= [A (T+P) + R] / 10.

Where: A=Ascorbic acid content (mg/gm), T=Total chlorophyll (mg/gm), P=pH of the leaf extract, R=Relative water content of leaf (%).

Analysis of soil nutrients

The Physio-chemical properties of soil were determined by following an alternative analytical indigenous technology developed by MCRC, IIT (M).

STASTICAL TOOL

The Mean and Standard deviation (S) was calculated by using the following formula:

Mean = Sum of x values / n (Number of values)

$$s = \frac{\sqrt{\sum(X-M)^2}}{n-1}$$

RESULTS AND DISCUSSION

Table.1 shows the results of biochemical changes involved in plant leaves.

Biochemical changes

Air pollution tolerance index is assessed by knowing the changes in pH, relative water content, ascorbic acid, chlorophyll. The pH assessed was found to be alkaline in all the plants studied. Similar result was reported by Krishnaveni et.al for *Ficus benghalensis*,[5,7,10]*Annona squamosa*,[5,9,10] *Millettia pinnatta*,[5] *Polyalthia longifolia*,[11] *Ficus religiosa*.[11,13] Relative water content observed was in the range of 34.29 to 81.57. *Polyalthia longifolia* showed lowest range of relative water content, while highest range was observed with *Wrightia tinctoria*. The relative water content of *Annona squamosa*,[10] *Psidium guajava*,[11] *Causuarina equesetifolia*[11] was supported by Krishnaveni et.al. Ascorbic acid level was higher for *Wrightia tinctoria*, while the level of ascorbic acid was lower with *Tectona grandis, Tamarindus indica, Annona squamosa*, *Atrocarpous heterophyllus*, *Ficus benghalensis*. Moderate amount of ascorbic acid was observed with *Ficus religiosa, Millettia pinnatta*, *Psidium guajava*, *Eucalyptus tereticornis*, *Azadirachta indica, Santalum album*, *Casuarina equisetifolia*, *Cicca acida*, *Wrightia tinctoria*, *Polyalthia longifolia*. The chlorophyll content calculated was higher for *Polyalthia longifolia*, whereas all the other plants showed moderate amount of chlorophyll content. The obtained chlorophyll content was similar to reports of Krishnaveni et.al for *Ficus religiosa*,[6,14] *Tamarindus indica*,[8,14] *Annona squamosa*,[10,13]*Millettia pinnatta*,[10]*Causuarina equesetifolia*,[12]*Tectona grandis.*[12,14] The combined changes in all

of these induces alteration in air pollution tolerance index level. The air pollution tolerance index level was higher with *Eucalyptus tereticornis*, all the other plants showed moderate level of air pollution tolerance index, but *Polyalthia longifolia* exhibits low level of air pollution tolerance index. *Polyalthia longifolia*,[10] *Azadirachta indica* [14]

Table.1. Biochemical changes in plant leaves

S.No	Name of the plants	pH	Relative water content (%)	Ascorbic acid(mg/g)	Chlorophyll (mg/g)	APTI
1.	*Tectona grandis*	9±0.00	64.75±03.03	0.07±0.01	0.39±0.10	6.48±0.26
2.	*Ficus religiosa*	8±0.00	54.18±02.65	0.13±0.06	0.28±0.00	7.52±2.05
3.	*Millettia pinnatta*	7±0.00	64.11±08.31	0.09±0.06	0.53±0.27	6.49±0.86
4.	*Psidium guajava*	6±0.00	71.41±10.59	0.25±0.17	0.32±0.10	7.23±0.95
5.	*Eucalyptus tereticornis*	6±0.00	76.56±00.17	0.19±0.12	0.51±0.09	7.77±0.09
6.	*Tamarindus indica*	6±0.00	46.53±07.82	0.07±0.01	0.41±0.08	4.69±0.79
7.	*Azadirachta indica*	7±0.00	60.07±12.66	0.26±0.14	0.39±0.07	6.03±1.45
8.	*Santalum album*	7±0.00	71.28±06.43	0.09±0.06	0.20±0.11	7.22±0.69
9.	*Casuarina equisetifolia*	6±0.00	61.59±16.22	0.09±0.06	0.40±0.20	6.23±1.66
10.	*Annona squamosa*	7±0.00	67.16±00.14	0.07±0.01	0.45±0.18	6.76±0.02
11.	*Cicca acida*	7±0.00	43.47±00.00	0.08±0.01	0.14±0.07	4.41±0.00
12.	*Wrightia tinctoria*	7±0.00	81.57±00.00	0.31±0.22	0.60±0.25	8.49±0.00
13.	*Artocarpus heterophyllus*	7±0.00	79.21±08.13	0.07±0.01	0.37±0.12	7.96±0.79
14	*hia longifolia*	7±0.00	34.29±16.21	0.10±0.04	0.99±0.81	3.77±1.18
15	*enghalensis*	8±0.00	64.46±02.38	0.07±0.01	0.63±0.07	6.50±0.25

Values are Mean ± SD for three experiments

showed similar results for APTI when compared with earlier studies. The obtained APTI values of each plant were categorized according to Kalyani and singaracharya, 1995.[16] The following are the four categories of APTI index range < 1=> very sensitive, 1to 16=> Sensitive, 17 to 29 => Intermediate and 30 to 100 => Tolerant. Based on this classification system, the plants were categorized to be sensitive, very sensitive, intermediate, tolerant etc. In our study, all the plants were found to be sensitive, as it has APTI value in the range of 1 to 16.

Soil nutrient analysis

The results of nutrients present in the soil are depicted in Table.2. Whereas, Table.3 depicts the normal nutrient values that has to be present in the soil.

The pH of the analyzed soil sample was 8.12, its electrolytic conductance, organic carbon observed was of 0.15, 0.62% respectively. The amount of Nitrogen, Potassium was medium when compared to normal nutrient table. While, the phosphorous content in the soil was found to be low. The nutrients such as Iron, Manganese, Copper,

Table-2 Showing results of soil samples collected near Indian oil gas plant

S.No	Nutrients	Results
1.	pH	8.12
2.	EC	0.15
3.	Organic Carbon(%)	0.62
4.	Nitrogen (Kg/acre)	136.39
5.	Phosphorus (Kg/acre)	17.17
6.	Potassium (Kg/acre)	128.23
7.	Calcium (mg/kg)	494.15
8.	Magnesium (mg/kg)	169.69
9.	Sodium (mg/kg)	151.37
10.	Iron (mg/kg)	11.86
11.	Manganese (mg/kg)	5.78
12.	Copper (mg/kg)	1.44
13.	Zinc(mg/kg)	0.84
14.	Boron (mg/kg)	0.36
15.	Sulfate (mg/kg)	29.15
16.	Humas (mg/kg)	98.69
	Total minerals (kg/acre)	281.78

Sulfate was higher, while, Boron was deficient and moderate amount of Zinc was observed. Calcium, Magnesium was also present in sufficient amount in soil. Humus content of the soil calculated was 98.69 kg/acre. Altogether, the overall total mineral content was found as 281.78kg/acre. The result of the present study was compared with previous reports of Krishnaveni et.al. The electrolytic conductance was similar to soil studied near railway junction, Salem, Tamil Nadu, India.[15] Likewise, the potassium content was similar to previous reports studied in New bus stand, Salem, Tamil Nadu.[17] Similar calcium content was reported in the soil samples studied near Thoppur hill,[18] Aavin milk diary.[14] The copper level observed was well correlated with the soil sample results assessed near Yercaud road side.[19]

CONCLUSION

The plants selected for the study were found to be sensitive. Sensitivity of the plants might be due to the low chlorophyll and ascorbic acid content present in the plant leaves. The total mineral content of the soil observed was

Table-3 Showing Normal Nutrient Values

Nutrient	Low	Medium	High
N(Kg/acre)	<113	113-182	>182
P(Kg/acre)	<18	18-36	>36
K(Kg/acre)	<60	60-138	>138
OC (%)	<0.75	0.75-1.5	>1.5
Mg (mg/kg)	<10	10-15	>15
HA (Kg/Acre)	<18	18-31	>31
Iron (mg/kg)	<6	6-8	>8
Mn (mg/kg)	<1	1.2-2.5	>2.5
Cu(mg/kg)	<0.3	0.3-1	>1
Zn(mg/kg)	<0.5	0.5-1	>1
Sulphur(mg/kg)	0-10	10-15	>15
Ca (mg/kg)	<300 (Deficient)	>300(Sufficient)	-
Boron (mg/kg)	<0.5 (Deficient)	>0.5(Sufficient)	-
Molybdenum (mg/kg)	<0.2 (Deficient)	>0.2(Sufficient)	-

281.78. The humus content of soil influences organic carbon level in soil. So, care is very much needed in protecting the plant life, which gives good, healthy, fresh air to breath.

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