Air Pollution Index of some selected Evergreen Plants across NH60 Road Side of Balasore District, Odisha, India

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Abstract- In the year 2005 NH-60 with 4lane almost completed. Now it is one of busiest National Highway for Transportation. It is less than near about 120km less than NH-5 Chennai to Calcutta. Now it is lifeline of Eastern part of Odisha. Due to ubanisation, Industrilation and Large vehicular transportation (due to more Ports are instituted in the cost of Bay of Bengal)Air pollution is increasing very rapidly. Air pollution along NH-60 is created stress on environment and public health problems. Generally there are more manmade pollutants near and along NH-60.Exposure of Evergreen plants to air pollutants crates many changes in physiological and biochemical changes. The present study was conducted on selected evergreen plants which are common such as Magnifera indica, L. (The Mango),Azardicta indica,) and Anthrocephalus indicus, (Kadamba) and Syzygium cumini (Jamun) exposed to pollutants along NH-60 Roadside. The Air Pollution Tolerance Index (ATPI) which determines the tolerance as well as sensitivity Levels of plants. Among the studied plants, Anthrocephalus indicus (Kadamba) showed high degree of tolerance.

Key wards; Air pollution, Biochemical changes, vital parameters, ATPI

I. INTODUCTION

Clean Air and Water the vital part of healthy life .It must be protected from bad effects of pollution at any cost. But the emittance of air pollution along NH-60 depletes the air quality may lead to serious health hazards and environmental consequences. The chemistry of air pollution is highly complex and involves hundreds of compounds as they emitted from the sources and additional compounds that form through the reactions in the atmosphere. The water, soil, plants, animals and human beings in nearby ecosystem are being badly affected by massive atmospheric pollution. The harmful effects of air pollution on vegetation have already been studied (Dasgupta,1957;Keller,1983;Agrawala etal,1991).Air pollutants produce various kinds of morphological, physiological and biochemical changes in plants. It is observed that Some higher plants are relatively high sensitivity to several air pollutants and sometimes fairly specific symptoms to counterpart the effects of pollutants, which can be easilydistinguishable. The above phenomena makes several plants as effective biological indicators of air pollution.

The present study has been carried out with the aim and objective of analyzing the air pollution tolerance index of 4 common evergreen trees growing natural conditions and their ability to withstand the stressful environment that prevails in some selected areas along National Highway-60 Road side in Balasore District, Odisha.

II. MATERIALS AND METHODS

The study area is located across NH-60 Road side in Balasore dist, Odisha. The place Naharpatna which is starting point of NH-60 was selected as site I. The places Rupsa, Basta (Gandhi Chhack) and Jaleswar were selected as site II, III and IV respectively. One of the zones near Baghajatin Park, at Nidhipanda was selected as site V which is thecontrl site.

The study was conducted in winter and summer seasons during 2012.Phyto monitoring of the selected sampling areas was with the aid of data sheet preapared.Field surveys were mainly made for different tree species occurring in the study area and monitoring the morphological changes in the habit of common trees present in the selected sites. The three evergreens dicotyledonous Magnifera indica, L. (The Mango), Azardicta indica, Anthrocephalus indicus, (Kadamba) and Syzygium cumini (Jamun) which are common in all five sites in the study area, were selected for the study.

Fully matured leaves in four replicates were taken. for the analysis from selected evergreen trees of almost same height 6m. The diameter at breast height (DBH) was taken as one of the criteria to bring out uniformity in age of trees. Leaves were collected in morning hours and very careful about that the samples were collected from plants growing in isiecologicalconditionswith

respect to light, water, soil, distance from NH-60 and pollutant exposure. The fresh leaves are analyzed for total chrophyll (Arnon, 1949), asorbicacid (Dubey and Aritphale, 1984), leaf extract pH(Varhney,1992) and relative water content(Barr and Weatherly,1962).

AIR POLLUTION TOLERANCE INDEX

Information on the susceptibility of trees species towards air pollutants is entirely based on the Air Pollution Tolerance Index(ATPI).These values are calculated using the formula by Singh and Rao(1983).

$$ATPI = \frac{\{A\ (T+P) + R\}}{10}$$

Where:

A= Ascorbic acid (mg/g fresh weight)

T=Total Chlorophylls (mg/g FW)

p=Leaf extract Ph

R=Relative water content (%)

III. RESULTS AND DISCUSSION

The results of phytomonitoring of the selected plants and the detailed the report of field survey are presented Table 1.Monitoringof the plants for the morphological changes revealed that Magnifera indica,L sites I,II,III,IV observed symptoms of chlorosis with chlorotic lesions. In most of the plants in sites I, II,III and IV observed chlorotic foliar patterns ,leaf abscission and leaf epinasty. In site V plants did not show any chlorosis and they were healthy. The results of ATPI and various parameters such as chlorophyll, leaf extract pH, ascorbic acid and relative water content(RWC) during the winter and summer seasons are presented in Tables 2 and Table 3.Magnifera indica,L(Mango) and Syzygium cumini (Jamun) in sites I,II,III and IV showed a considerable reduction in foliar chlorophyll and ascorbic acid contents and a more acidic foliar PH compared to that of site Vin both the seasons while Anthrocephalus (Kadamba) in sites I,II,III and IV showed no significant change in the foliar pH and ascorbic acid level compared to that of site V.From the analysis of the results of RWC of different plants species studied,Anthocephalus (Kadamba) showed high RWC compared to other species. Based on the values ofATPI,the tolerance level of three selected plants can be arranged in the following order Anthrocephalus indicus (Kadamba) >Azadirctaindica (Neem),>Magnifera indica (Mango)

It has been reaveld that pollutant gases such as So_2 , No_2, No_3(oxides of Nitrogen) and Ozone produce oxyradicals in reaction with plant bioproducts.These radicals cause widespread damage to membranes and associated molecules including chlorophyll pigments.(Agrawal and Tiwary,1997).The reduction in chlorophyll can also be attributed to So_2 including activity resulting in removal of Mg^{++} ions, which convert it into phaeophytin,,modify the light spectrum characteristics, (MALHOTRA, 1977; Suwannapinut and Kozolowski, 19790)

TABLE-1. Details of Phytomonitoring

Botanical Name	Common Name	Type	Frequency	Moroholological symptoms
1.Azardica indica	The Neem	Deciduous	Site I, II, III, IV, V	Slightly chlorotic Injury
2.Magnifera indica	The Mango	Ever Green	Site I,II,III,IV,V	Chlorotic Injury
3.Anthocephalus indicus	The Kadamba	Evergreen	SiteI,II,III,IV,V	No apparent injury

Table -2. Foliar Chlorophyll, Ascorbic acid content and Leaf Extract PH (average four replicates)

Plant Name	Site	Total Chlorophyll		Leaf Extract pH		Ascorbic Acid	
		Winter	Summer	Winter	Summer	Winter	Summer
Magnifera indica (Mango Tree)	I	2.880	1.920	5.244	5.150	2.354	1.990
	II	2.165	1.444	4.651	4.442	1.910	0.773
	III	1.758	0.865	4.740	4.303	0.731	0.1120
	IV	1.212	0.632	4.826	4.637	2.440	2.380
	V	3.976	3.810	6.555	6.382	2.650	2.551
Azadiracta indica	I	3.255	2.750	4.875	4.460	3.455	3.273

Neem tree	II	3.244	2.712	4.660	4.425	3.120	3.012
	III	3.127	2.567	4.524	4.228	2.984	2.877
	IV	2.990	2.450	4.475	4.210	2.645	2.586
	V	4.567	4.332	6.758	6.728	4.318	4.122
Anthocephalus indicus	I	6.212	6.119	6.623	6.633	8.325	7.792
	II	5.646	5.465	5.888	5.783	7.828	7.658
	III	5.856	5.550	6.882	6.377	8.210	7.835
	IV	5.377	5.289	6.446	6.413	8.7111	7.764
	V	6.850	6.550	6.358	6.090	8.173	8.080

Site I-Near Nahar patna, SiteII- Rupsa, SiteIII-Gandhi chhack Bypass, SiteIV-Jaleswar, SiteV-Baghajatin park, Nidhi Panda Pollution stress is found to causevdreaseed level of chlorophyll content. Reduction in chlorophyll of plants exposed to air enriched by So_2.Those plants with high chlorophyll content are generally tolerant of So_2 pollution.

Table3.

Plant Name	Site	Relative water content(RWC)%		Air Pollution Tolerance Index APT	
		Winter	Summer	Winter	Summer
Magnifera indica(Mango Tree)	I	61.332	59.819	8.196	7.383
	II	55.213	50.873	6.823	5.506
	III	52.387	48.440	5.713	4.901
	IV	51.348	45.550	6.608	5.809
	V	66.219	64.210	9.409	9.209
Azadiracta indica	I	67.410	62.320	9.549	8.591
Neem tree	II	65.138	64.737	8.983	8.623
	III	62.821	60.982	8.565	8.053
	IV	60.129	60.110	7.987	7.733
	V	69.528	68.323	11.842	11.391
Anthocephalus indicus	I	74.737	74.428	18.158	17.377
Kadamba tree	II	73.128	72.110	16.341	15.824
	III	71.898	71.378	17.319	16.482
	IV	70.015	70.220	16.591	16.106
	V	76.993	76.228	18.494	17.833

Ascorbic acid is natural antioxidant which maintains stability of the plant cell membranes during pollution stress and scavenges cytotoxic free radicals. The analysis of the result of ascorbic acid content in different plant species studied in five study sites showed that there is a decrease in ascorbic acid content in the case of Magnifera indica (Mango) and Azadiracta indica (Neem tree) in the control site V. The observation on the ascorbic contents of leaves in the present study showed that higher degree of pollution lowers the ascorbic acid.

The results of leaf extract of P H of three selected plants showed considerable variation. Pollution tolerant Anthocephalus indicus (Kadambatree)has more PH.

Relative water content (RWC) of a leaf is the water present irrelative to its full turgidity. It is associated with protoplasmic permiabilityin cells. Therefore those plants with high RWC underpolluted conditions may be

tolerant to pollutants. RWC was found to maximum, Anthocephalus indicus(Kadamba tree) and minimum in Magnifera indica(Mango Tree).

Different plant species vary considerable in their susceptibility to air pollution. The plants with high ATPI and low ATPI can serve as tolerant and sensitive species respectively.(Singh and Rao, Magnifera indica(Mango Tree 1983).Thus the results of the study reveals that Anthocephalus indicus (Kadamba tree) with higher ATPI can be considered as tolerant plant and Magnifera indica(Mango Tree) with a lower ATPI as sensitive plant to air pollution in which the former can serve as sink.

IV. CONCLUSION

The result of the present study showed that sensitivity response of the three selected plants was in the order Anthocephalus indicus (Kadamba tree)>Azadiracta indica (Neem tree)> Magnifera indica (Mango Tree).This piece of work will be helped for greening across NH-60 for control of air pollution.

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