World Journal of Environmental Biosciences
Available online at:
www.environmentaljournals.org Volume 1, Issue 1:
51-54

Open Access Research Article

# Air Pollution Tolerance of Selected Plant Species Considered for Urban Green Belt Development in Trichy

**Sirajuddin. M. Horaginamani*, M. Ravichandran* and Abdul Samad. M. Kamdod***

*Department of Environmental Management, School of Environmental Sciences,
Bharathidasan University, Tiruchirappalli-620 024, Tamil Nadu, India.
** Department of Civil Engineering, Bharat Institute of Engineering and Technology, Mangalpalli-501 510,
Ibrahimpatnam, Ranga Reddy District, Andhra Pradesh.

***Corresponding author: ecosirajuddin@yahoo.com**

## Abstract:

**Urban green belts are considered the lungs of the cities as they act as a sink for some of the harmful gases released by vehicles and industries operating in the city area. Whether sprawling over a large area or a small belt, these green belts are found in all cities and play a very important role. Today, urban areas in India are faced with excessive population along with the pressure of unplanned economic development, industrialization, and vehicular emissions. Vegetation naturally cleanses the atmosphere by absorbing gases and some particulate matter through leaves. Plants have a very large surface area and their leaves function as an efficient pollutant-trapping device. Some plants have been classified according to their degree of sensitivity and tolerance towards various air pollutants. Sensitive plant species are suggested to act as bio-indicators. Levels of air pollution tolerance vary from species to species, depending on the capacity of plants to withstand the effect of pollutants without showing any external damage. In this study, the air pollution tolerance index (APTI) of 30 plants from Tiruchirappalli city has been evaluated. In the present study the maximum APTI is observed in *Azadirachta indica* and minimum is *Psidium spicigera.* The anticipated performance index (API) of 30 plants has also been evaluated for green belt (GB) development in and around traffic intersections of Tiruchirappalli city of south India . Using APTI and this performance rating, the most tolerant plants have been identified.**

**Keyword:** Urban green belts, air pollution tolerance, bio-indicators, Tiruchirappalli

## 1.0 Introduction:

Urban green belts are considered the lungs of the cities as they act as a sink for some of the harmful gases released by vehicles and industries operating in the city area. Whether sprawling over a large area or a small belt, these green belts are found in all cities and play a very important role. Today, urban areas in India are faced with excessive population along with the pressure of unplanned economic development, industrialization, and vehicular emissions. This has led to considerable rise in urban pollution, affecting air, water, and land. Air pollution has increased rapidly in many cities and metropolises, especially due to vehicular traffic and industrial emissions. Over the years rising population has led to a decrease in open spaces and green belts in the cities. These green belts serve as lungs for cities and towns. They serve as a sink for pollutants, check the flow of dust and bring down noise pollution level. Plants provide innumerable environmental benefits and considering the steady increase in air pollution it has become imperative to increase the green belts in and around the cities.Air pollutants in urban and industrial areas may be adsorbed, absorbed, accumulated or integrated into the plant body and, if toxic, may injure them to some degree. The level of injury will be high in sensitive species and low in tolerant ones. Sensitive species are useful as early warning indicators of pollution, and the tolerant ones help in reducing the overall pollution load, leaving the air relatively free of pollutants .There are various mechanisms for minimizing the level of air pollution. Natural processes include precipitation, chemical reaction, sedimentation and absorption . Plants, the main GB component, act as a sink and as living filters to minimize air pollution by absorption, adsorption, detoxification, accumulation and/or metabolization without sustaining serious foliar damage or decline in growth, thus improving air quality by providing oxygen to the atmosphere . The present study examines the selection of plant species which can be grown around industrial/urban areas in India. Plants differ considerably with reference to their responses towards pollutants, some being highly sensitive and others hardy and tolerant. On the basis of the air pollution tolerance index (APTI) and some relevant biological and socioeconomic characters, the anticipated performance index (API), from best to not recommended, of various plant species was determined for GB development.

## 2.0 Methods and Methods:

Tiruchirappalli city (10.5°N , 78.43°E,78.8 MSL) the heartland of Tamil Nadu , is situated on the banks of river Cauvery and spread over an area of 146.90 sq. Km with total population of above 7, 50,000.Tiruchirappalli the fourth largest city (after Chennai, Coimbatore and Madurai) of Tamil Nadu, is rapidly growing in terms of its population and number of vehicles. Which intern leads to more traffic, congestion and undesirable change in air quality. The study was conducted in July 2008 to June 2009. Leaf samples were collected from 15 different plants species growing commonly in road junction areas of city and their APTI was determined .The Polythene bags were used for storing leaf samples during transportation. The leaf samples were refrigerated at about $20^0$ C, when they had to be stored. The samples were estimated for Leaf-extract pH (Singh and Rao 1983), relative moisture content (Wealtherly, 1965), total chlorophyll (Arnon, 1949) and ascorbic acid (Keller and Schwanger,1977).Estimation of Leaf-extract pH: 0.5 g of leaf material was ground to past and dissolved in 50 ml of distilled water and Leaf-extract pH was measured by using calibrated digital pH meter. Estimation of relative moisture content: Fresh leaf samples collected from the study area and were brought immediately to the laboratory and washed thoroughly. The excess water was removed with the help of filter paper. The initial weight of samples were taken (W1 g) and kept in oven at $60^0$ C until constant weight was obtained and the final weight was taken (W2 g).Total Chlorophyll was estimated by acetone extraction method and ascorbic acid was estimated by 2,6-dichlorophenol indophenol dye method.

**APTI is given by APTI = {[A (T + P) + R] / 10}**
**Where**
**A, is the ascorbic acid, mg/g;**
**T, total chlorophyll, mg/g;**
**P, pH of leaf sample;**
**and R, relative water content, mg/g.**

## 3.0 Result and Discussion:

The air pollution tolerance index (APTI) value of 30 different plants growing commonly in traffic area of the city is given in table 1. In the present study the maximum APTI is observed in *Azadirachta indica*12.95 and minimum in *Enterolobium saman,* 7.12 (Table 1) Nrusimha et al., (2005) have studied the APTI of many plant species and established the maximum APTI value for *Azadirachta indica* to be 16.50 and minimum *Pongamia glabra* . Agarwal,S.K and D.C Bhatnagar in1991 studied APTI of some selected plants and described *Mongifera indica* as reliable bioaccumlator plant. Rao (1971), Agarwal and Agarwal (1988) also reported high sensitivity of *Mongifera indica. Azadirachta indica, Psidium quajava , Mongifera indica , Bauhinia purpura, Largerstromia indica, Morinda tinctora, Hibiscus rosasinensis, Ixora coccinea , Polyalthia longifolia, Achras sapota* and *Cassia fistula* are reported high APTI values and considered as tolerant plant. The higher APTI values are building resistance in plants depends on various strategies, including stomatal movement, enzymatic actions and detoxifying process as well as genetical and developmental factors. These above said tolerant plants can be used for afforestration in urban area and nearby traffic intersections to mitigate air pollution including traffic pollution.

The other plants with low APTI value like *Bauhinia purpura, Pongamia glabra, Citrus aurantifolia* and *Enterolobium saman* shows susceptibility towards traffic pollution. Similar observations are made by Rao and Dubey (1991) and noticed ten plants susceptible to air pollution in Ujjain city. However, this study is considered only commonly growing plants in traffic areas. Further studies on APTI of various plants in respect to different seasons of Tiruchirappalli city are required to find out.

**Table 1: APTI of plant species in Tiruchirappalli city**

| Sr. No. | Plant species | Total Chlorophyll (mg/gm fresh wt) | Leaf extract pH | Ascorbic acid (mg/gm dry wt) | Relative water content (%) | APTI |
|---|---|---|---|---|---|---|
| 1 | *Achras sapota* | 4.3 | 88.22 | 0.97 | 1.71 | 9.72 |
| 2 | *Azadirachta indica* | 5.9 | 90.77 | 0.42 | 6.14 | 12.95 |
| 3 | *Anthocephalus cadamba* | 2.12 | 6.11 | 1.12 | 83.42 | 9.26 |
| 4 | *Artocarpus integrifolius* | 2.04 | 5.08 | 3.96 | 66.12 | 9.43 |
| 6 | *Bauhinia variegata* | 1.96 | 5.79 | 1.53 | 65.99 | 7.78 |
| 7 | *Butea monosperma* | 2.18 | 5.62 | 2.46 | 78.60 | 9.78 |
| 8 | *Cassia fistula* | 3.88 | 5.72 | 3.76 | 72.68 | 10.87 |
| 9 | *Cassia renigera* | 2.62 | 5.44 | 4.96 | 80.71 | 12.07 |
| 10 | *Cassia siamea* | 1.97 | 4.46 | 4.40 | 70.26 | 9.86 |
| 11 | *Casurina equisetifolia* | 1.48 | 5.11 | 2.27 | 78.54 | 9.35 |
| 12 | *Dalbergia sissoo* | 3.18 | 5.72 | 2.30 | 78.62 | 9.91 |
| 13 | *Eugenia jambolana* | 1.43 | 4.56 | 3.42 | 72.65 | 9.31 |
| 14 | *Ficus benghalensis* | 1.68 | 8.14 | 2.32 | 82.26 | 10.50 |
| 15 | *Ficus infectoria* | 1.61 | 7.82 | 1.45 | 86.16 | 9.98 |
| 16 | *Ficus religiosa* | 1.78 | 5.62 | 3.46 | 80.72 | 10.63 |
| 17 | *Grevillea robusta* | 2.58 | 5.22 | 2.50 | 72.10 | 9.16 |
| 18 | *Jacaranda mimosifolia* | 3.12 | 5.25 | 1.28 | 63.74 | 7.44 |
| 19 | *Madhuca latifolia* | 1.30 | 4.58 | 3.62 | 83.20 | 10.44 |
| 20 | *Mangifera indica* | 4.16 | 5.28 | 3.24 | 92.18 | 12.27 |
| 21 | *Melia azedarach* | 2.82 | 5.54 | 3.68 | 71.80 | 10.26 |
| 22 | *Mimusops elengi* | 2.82 | 5.20 | 2.48 | 81.48 | 10.14 |
| 23 | *Moringa pterygosperma* | 2.36 | 5.42 | 4.76 | 84.70 | 12.17 |
| 24 | *Putranjiva roxburghii* | 2.41 | 4.78 | 2.02 | 83.07 | 9.76 |
| 25 | *Parkinsonia aculeata* | 2.14 | 5.38 | 2.84 | 77.26 | 9.86 |
| 26 | *Polyalthia longifolia* | 5.2 | 90.99 | 0.18 | 1.43 | 9.86 |
| 27 | *Pongamia glabra* | 4.4 | 84.30 | 0.38 | 0.93 | 8.87 |
| 28 | *Psidium quajava* | 6.6 | 81.97 | 0.21 | 6.64 | 7.21 |
| 29 | *Saraca indica* | 1.79 | 5.46 | 1.42 | 86.68 | 9.70 |
| 30 | *Spathodea campanulata* | 2.84 | 5.46 | 2.12 | 81.62 | 9.92 |

## 4.0 Conclusion:

Eco-environment conservation and pollution abatement through GB are two major components which are vital for any activity, whether proposed existing or under expansion stage. GB development plan for a particular sector mainly depends upon: (i) nature and extent of pollution load, (ii) sinking capacity of the ecosystem, (iii) climatic factors and (iv) soil and water quality.

## 5.0 Acknowledgment:

Authors express their sincere thanks to R. Rameshkumar, Department of Biotechnology, Alagappa University, Karaikudi for their help and assisstance.

## References:

1) Agarwal,S.K and D.C Bhatnagar (1991) Auto Vehicular air pollution induce pigment and ascorbic acid changes in avenue plants. Acto Ecologica, 13(1) CK: 1-4.
*2)* Rao DN. Study of the air pollution problem due to coal unloading in Varansi, India. Proc. 2nd Internatl. Clean Air Congress, (eds) H.M. England and W.T. Berry, Academic Press, New York, 273-276, 1971.
*3)* Rao MV, Dubey PS Detoxifying mechanism: Probable role in deterniining the plant response to $SO_2$ under different light intensities.*Indian J Environ Toxico*, 1 (1)(1991), 39-45
4) Weatherly PE. The state and movement of water in the lea. *Symposium of the society of Experimental Biology* 1965; 19: 157-184
*5) en.wikipedia.org/wiki/Green_belt*