

Original Article

AIR POLLUTION TOLERANCE INDEX OF PLANTS A COMPARATIVE STUDY

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ABSTRACT

**Objective:** Air pollution is both anthropogenic and natural. But, whatever mode, whether natural or artificial, it is a major concern in to-days developing country like India. Since, pollution is an upcoming issue, we aimed at assessing the air pollution tolerance index of plants at two different locations. The locations selected were near road sides of railway junction (location 1) and its residential area (location 2). 12 plants available commonly in both locations were selected for the present research.

**Methods:** pH, ascorbic acid, total chlorophyll, relative water content, carotenoid, air pollution tolerance index was performed by using standard methods.

**Results:** The air pollution tolerance index was high for *Syzygium cumini* in location 1 and *Ficus benghalensis* in location 2. Pigment and ascorbic acid content observed was less in both the locations studied. Moderate relative water content was noticed.

**Conclusion:** All plants studied in both the locations were found to be sensitive to pollution which ranges from 02.29 to 12.53. No species studied were found tolerant to pollution. Hence, it is essential to protect the plants. The variation might be due to the reflection of altered biochemical parameters.

**Keywords:** APTI, Ascorbic acid, Chlorophyll, Relative water content, pH.

INTRODUCTION

Air pollution is one of the severe problem world is facing today. It deteriorates ecological condition and can be defined as fluctuation in any atmospheric constituent from the value that would have existed without human activity. [1] Over the years, there has been a continuous growth in human population, road transportation, vehicular traffic and industries which increases the concentration of gaseous and particulate pollutants. [2] The locations selected was near railway junction. Hence, plants located near road sides of railway junction and its residential area were selected for the present study. The road sides of residential area which is 1km away from railway junction. Hence, plants that were commonly available was considered for the whole study. 12 plants studied are as follows: *Azadirachta indica*, *Pongamia pinnata*, *Polyalthia longifolia*, *Albizia saman*, *Ficus religiosa*, *Tamarindus indica*, *Mangifera indica*, *Syzygium cumini*, *Pithecellobium dulce*, *Annona squamosa*, *Ficus carica*, *Ficus benghalensis* were assessed for its air pollution tolerance index in both the locations studied were compared to know its sensitiveness/ tolerance level to pollution.

MATERIALS AND METHODS

Leaf sample collection

For the present study, fresh leaves from each plants were collected from the experimental sites near road sides of Railway junction (study area 1) and near road sides of its Residential area (study area 2) during the month of January, 2014. Common plants identified were selected from both areas.

Extract preparation

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

Biochemical parameters

pH

100mg of fresh leaves was homogenized in 10ml deionized water. This was filtered and 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°C and reweighed to obtain the dry weight. RWC was determined and calculated by the method as described by Singh 1977. [3]  $RWC = \frac{FW - DW}{TW - DW} \times 100$ . Where: FW-Fresh weight, DW-Dry and TW-Turgid weight.

Ascorbic acid content

Ascorbic acid content was measured by Titrimetric method of Sadasivam 1987 [4] 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 colour develops. Similarly a blank is also developed.

Total chlorophyll and carotenoid content

This was carried out according to the method described by Arnon 1949 [5]. 500mg of fresh leaves were blended and then extracted with 10ml of 80% acetone and left for 15min. The liquid protein was decanted into another test tube and centrifuged at 2,500rpm for 3min. The supernatant was then collected and the absorbance was taken at 645nm and 663nm for chlorophyll a, b and 480, 510 nm for carotenoid using a micro controller based visible spectrophotometer (340- 990nm). Calculation were done by using the formula given below:

Total chlorophyll: Chlorophyll a + Chlorophyll b; CTC:  $20.2 (D_{645}) + 8.02 (D_{663})$

Tch:  $0.1 CT \times \left[ \frac{\text{leaf dry weight}}{\text{leaf fresh weight}} \right]$ , Carotenoid =  $7.6 \times 480 OD - 1.49 \times 510 OD$

Calculation of APTI

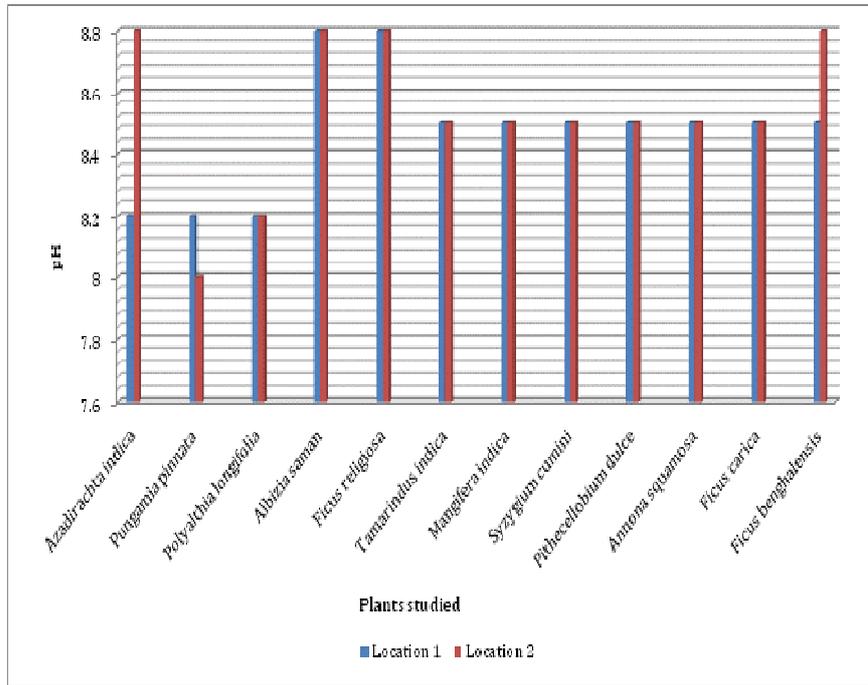
The air pollution tolerance indices for the selected plants were determined by following method of Singh and Rao (1983). [6] The formula is given as:  $APTI = \frac{A (T+P) + R}{10}$ . Where: A=Ascorbic acid content (mg/gm), T=Total chlorophyll (mg/gm), P=pH of the leaf extract, R=Relative water content of leaf (%).

**RESULTS AND DISCUSSION**

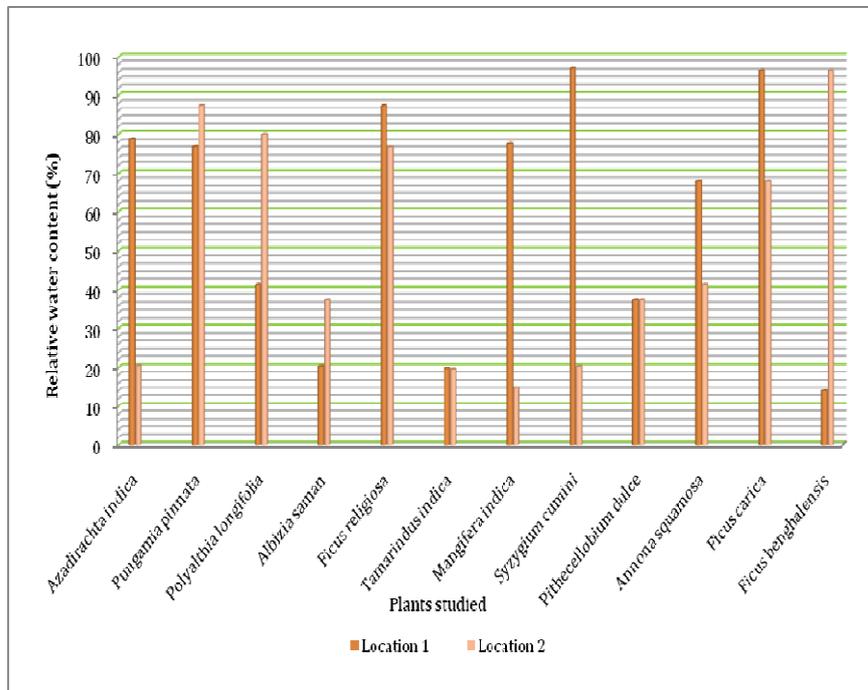
The results of each biochemical components and air pollution tolerance index are enumerated in Fig.1 to Fig. 6.

**PH**

The pH observed was found to be same for all the plant leaves studied at two selected locations.



**Fig.1: pH of plants**



**Fig. 2: Relative water content**

The results of relative water content is shown in Fig.2. The relative water content was high with *Ficus carica* while, it was low with *Ficus benghalensis*. All the other plants showed relative water content in the range of 20.25 to 78.90% with respect to location 1. In location

2, the relative water content was high with *Ficus benghalensis* and low with *Mangifera indica*, most of the plants collected from this location found to contain relative water content in the range of 19.61 to 87.49%.

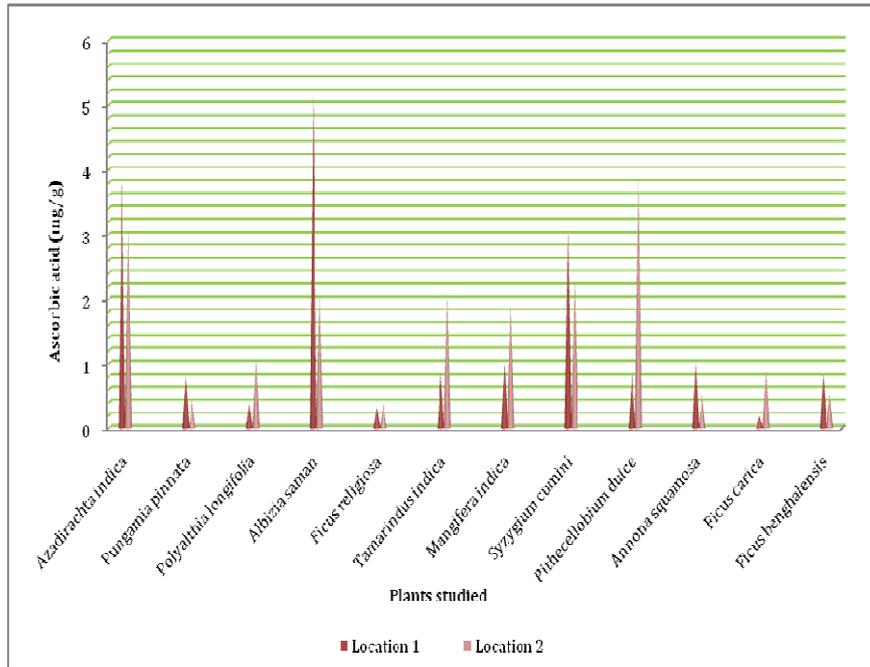


Fig.3: Ascorbic acid content

The ascorbic acid content is shown in Fig. 3. In location 1, the ascorbic acid content was high with *Azadirachta indica* and very low with *Ficus carica*, most of the plants collected in location 1 found to contain ascorbic acid in the range of 0.32 to 3.09mg/g ascorbic acid. In location 2, ascorbic acid content was high for *Pithecellobium dulce* and very low with *Ficus religiosa*, rest of the plants have ascorbic acid content in the range of 0.42 to 3.1mg/g ascorbic acid. Similar result was reported by Krishnaveni et.al [7] for *Azadirachta indica* in both the location and also for *Syzygium cumini* in location 1. Value closer to this was reported by Krishnaveni et.al [8] for *Annona squamosa* in location 2.

The results of Total chlorophyll is shown in Fig.4. The chlorophyll level was higher with *Ficus benghalensis*, and low with *Mangifera indica* in location 1. All the other plants showed values in the range of 0.08 to 1.56mg/g chlorophyll. Likewise, it was high with *Pithecellobium dulce*, *Azadirachta indica* whereas, it was low with *Tamarindus indica*.

All the other plants showed chlorophyll content in the range of 0.31 to 0.49mg/g chlorophyll. Similar result was reported by Krishnaveni et.al [9,10] for *Polyalthia longifolia*, *Pongamia pinnata* in location 2

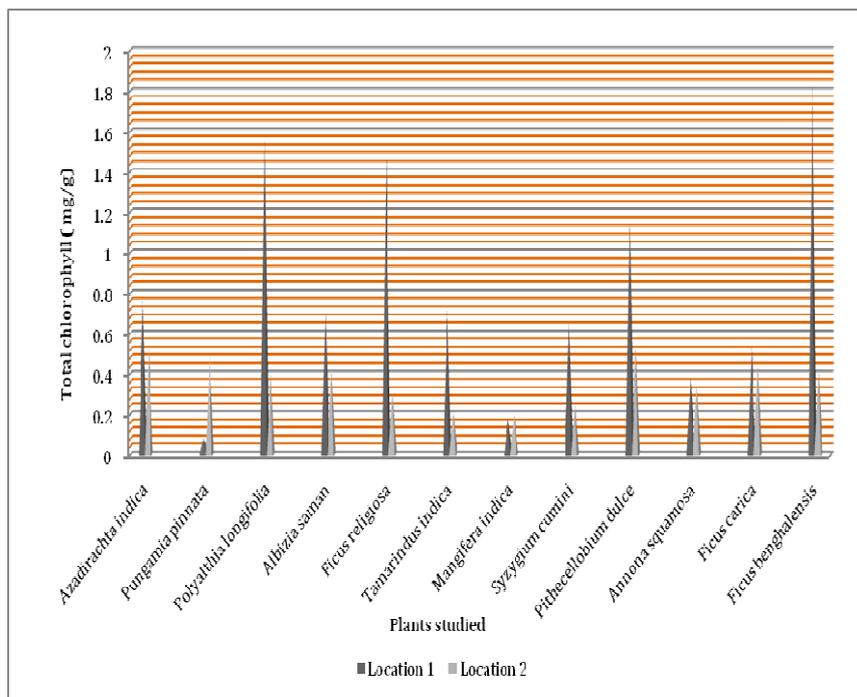


Fig. 4: Total chlorophyll content

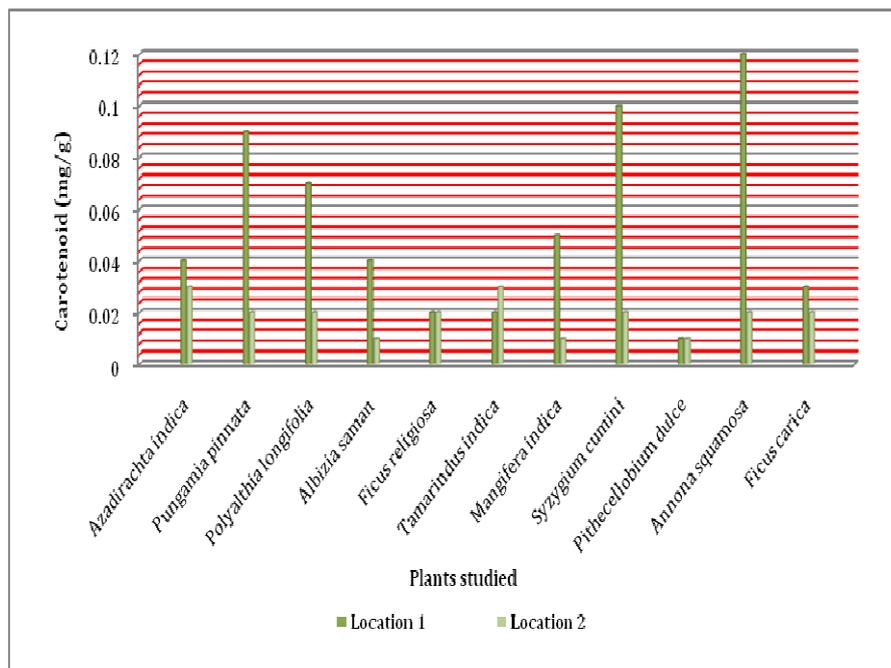


Fig. 5: Carotenoid content

The carotenoid content was depicted in Fig. 5. The carotenoid content was higher with *Annona squamosa*, *Syzygium cumini* where as it was very low with *Pithecellobium dulce* in location 1. Other plants showed carotenoid value in the range of 0.02 to 0.09mg/g in first location. In location 2, the carotenoid content was higher with

*Tamarindus indica*, whereas, it was low with *Mangifera indica*, *Pithecellobium dulce*, *Albizia saman*, all the other plants found to contain 0.02mg/g carotenoids. Similar result was reported by Krishnaveni et.al [11] for *Ficus religiosa*, *Ficus benghalensis* in location 1 and 2.

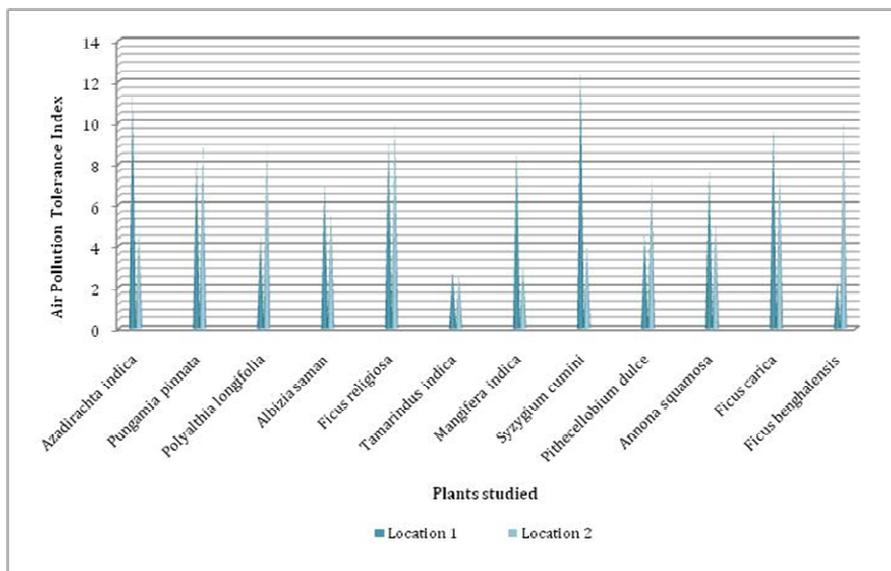


Fig. 6: Air Pollution Tolerance Index

The air pollution tolerance index of plants analysed in both the locations are shown in Fig. 6. The tolerance index for the location 1 ( near road sides of railway junction) is given here in the decreasing order: *Syzygium cumini* <*Azadirachta indica*< *Ficus carica*< *Ficus religiosa*< *Mangifera indica*< *Pongamia pinnata*< *Annona squamosa*< *Albizia saman*< *Pithecellobium dulce*< *Polyalthia longifolia*< *Tamarindus indica*< *Ficus benghalensis*.

Likewise, the air pollution tolerance index of plants studied at second location ( near road sides of residential area). The increase in

index value is given as follows: *Tamarindus indica*> *Mangifera indica*> *Syzygium cumini*> *Azadirachta indica*> *Annona squamosa*> *Albizia saman*> *Pithecellobium dulce*> *Ficus carica*> *Polyalthia longifolia*> *Pongamia pinnata*> *Ficus religiosa*> *Ficus benghalensis*.

Similar result was reported by Krishnaveni et.al [12] for *Ficus benghalensis* situated in location 2. From this, it is clear that APTI was high with *Syzygium cumini* and *Ficus benghalensis* in location 1 and 2 studied. The changes observed in the plants at different locations were mainly due to the pollutants causing leaf injury,

stomatal damage, early senescence, decreased photo synthetic activity, disturbed membrane permeability and condensed growth, yield in sensitive plant species. [13]

#### CONCLUSION

Plants that are continuously exposed to pollutants leads to accumulation of pollution, integration of pollutants in to their own system, thereby altering the nature of leaf and make them more sensitive. This sensitivity is measured through various biochemical changes and finally to air pollution tolerance index. In our study, all the plants were found to be sensitive species.

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