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Comparative Study for Air Pollution Tolerance Index of Taberneamontana Divericata

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ABSTRACT
Air Pollution Tolerance Index of *Taberneamontana divericata* plant of polluted road side and unpolluted park at Bhopal, Madhya Pradesh, India has been studied. Phytochemical test such as pH, relative water content, total chlorophyll content and total ascorbic acid of the leaf extract was measured by the standard methods. The Air pollution tolerance index (APTI) was calculated for two leaf samples, one collected from traffic polluted road side and another from a nearby unpolluted park. The study revealed that higher value of APTI of leaves of *T. divericata* was found at polluted road side than the leaves collected from unpolluted Park. This indicates the tolerance capacity depends on its phytochemical content i.e. pH, relative water content, total chlorophyll content and total ascorbic acid of leaf of plant.
Keywords—Tabernaemontana divaricata, leaf, total chlorophyll content, total ascorbic acid content, air pollution tolerance index

1. Introduction
The plants at road side play a significant role in assimilation and accumulation of pollutants and act as efficient interceptors of airborne pollutants. Adverse impacts of urban air pollution on leaf structure of plants have been studied by various researchers previously [1-3]. Vehicles exhaust emissions are a dominant feature of urban environments and are widely believed to have detrimental effects on plants [4]. Some plants thrive in environments that others would find toxic, these plants can clean-up various sources of man- made pollution; both organic (petrochemical) and inorganic heavy metal toxins [5]. Air pollutant can include sulphur, nitrogen oxides, carbon monoxide, soot particles and smaller quantities of toxic metals organic molecules and radioactive isotopes. These pollutants directly affect plants via leaves or indirectly via soil acidification [6]. Most plants experience physiological changes before exhibiting visible damage to leaves [7]. Thus, the adverse effect of air pollution have been studied by taking selected parameters such as chlorophyll content [8-14], relative moisture content [15-16], ascorbic acid content [17] and air pollution tolerance index of some plants have been calculated [18-19]. APTI has been used to identifying tolerance levels of plant species [20-23]. Plants to remove toxins is an attractive and cost effective way to improve air quality and can play important role in controlling air pollution and this process called as Phytoremediation. Appropriate planning and planting scheme determined by the degree and nature of pollution, selection of pollution lenient and dust absorbing trees and shrubs should be done for bioremediation of environmental pollution [24]. The response of plants to air pollution at physiological and biochemical levels can be understood by analyzing Air Pollution Tolerance Index (APTI). APTI is calculated by using four biochemical parameters such as pH, relative water content, total chlorophyll content and total ascorbic acid ascorbic acid. Species having higher APTI value are more tolerant to air pollution than those having lower APTI value and these species having lower APTI value may act as bio-indicators of pollution. Therefore, this

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study was based on comparative value of APTI of the leaves of *T. divericata* collected from polluted road side and the leaves collected from unpolluted Park.

2. Methodology

2.1 Sampling

For Air Pollution Tolerance Index (APTI) study, leaf samples of *T. Divericata* was collected and authenticated by Botanist, Safia College of Science, Bhopal, Madhya Pradesh, India. One leaf sample was collected from polluted road side and another leaf sample was collected from a nearby unpolluted park at Bhopal city, Madhya Pradesh, India.

2.2 pH of Leaf Extracts

Two samples of fresh leaves are homogenized in 10 ml. of deionised water and filtered the leaf extract. The pH of the leaf extract determined after calibrating pH meter with buffer solution of pH – 4 [23].

2.3 Relative Water Content (RWC)

Fresh weight of leaf was recorded by weighing the fresh leaves. To get the dry weight the leaves are dried in an oven at 70ºC for overnight and then the dry weight will taken. For obtaining the turgid weight, the leaves are immersed in water over night, blotted dry and then weighed. Relative water content is determined by the formula as below [25]:

Relative Water Content (RWC) = FW - DW / TW – DW x 100

Where, FW – Fresh weight of leaf, DW – Dry weight of leaf, TW – Turgid weight of leaf.

2.4 Total Chlorophyll Content

Fresh leaves of booth plants were collected for total chlorophyll content analysis. For the total chlorophyll determination 0.5 g fresh leaf material will ground and diluted in 10 ml of distilled water. A subsample of 2.5 ml will mix in 10 ml acetone and left to stand for 15 min. It will filtered and centrifuged at 2500 rpm for 3 min. Optical density of the supernatant will read at 645 nm and 663 nm using a digital spectrophotometer. The concentrations of chlorophyll a and chlorophyll b (mg/g- fresh leaf) are obtained using the following formula [26]:

OT = 20.2 (D 645) + 8.02 (D663)

Total Chlorophyll (mg/gm dry wt.) = 0.1 OT x (leaf dw / leaf fw)

Where, FW – Fresh weight of leaf, DW – Dry weight of leaf

2.5 Total Ascorbic Acid Content

Standard calibration curve of ascorbic was established by graphing concentrations versus absorbance of ascorbic standard solutions by taking 10 ml of each of standard solutions and put in a test tube, then 1 ml of $KMnO_4$ solution (100 µg/ml) was added. This solution was left to stand for 5 minutes. The absorbance of these standard solutions was read at 530 nm against blank. After calibration, Take 10 ml of each of extract sample (1 mg/ml) and put in a test tube, then 1 ml of $KMnO_4$ solution (100 µg/ml) was added. This solution was left to stand for 5 minutes. The absorbance of these standard solutions was read at 530 nm against blank with an UV/Visible spectrophotometer method [27].

2.6 Air Pollution Tolerance Index (APTI)

Determination APTI was calculated by the formula as below [20]:

APTI = A (T+P) +R / 10

Where,

A = Total ascorbic acid content (mg/g),

T = Total chlorophyll (mg/g), P = pH of leaf extract,

R = Relative water content of leaf.

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3. Result & Discussion

Results of pH, relative water content, total chlorophyll content and total ascorbic acid for determination of APTI of both leaf samples collected from polluted road side and unpolluted park are depicted in table 1 and shown in figure 1.

Table 1: Results of comparative study of APTI

Sample Name	pH of Leaf Extract	Relative Moisture (%)	Total Chlorophyll Content (mg/100 mg)	Total Ascorbic Acid Content (mg/100 mg)	APTI
Leaf 1	6.8	78.41	3.367 (Chlorophyll a- 2.731and Chlorophyll b- 0.636)	2.651	10.83
Leaf 2	6.5	70.82	4.486 (Chlorophyll a- 4.194 and Chlorophyll b- 0.295)	0.114	07.19
Where, Leaf 1 = Leaf Collected From Polluted Road Side, Leaf 2= Leaf Collected From Unpolluted park					

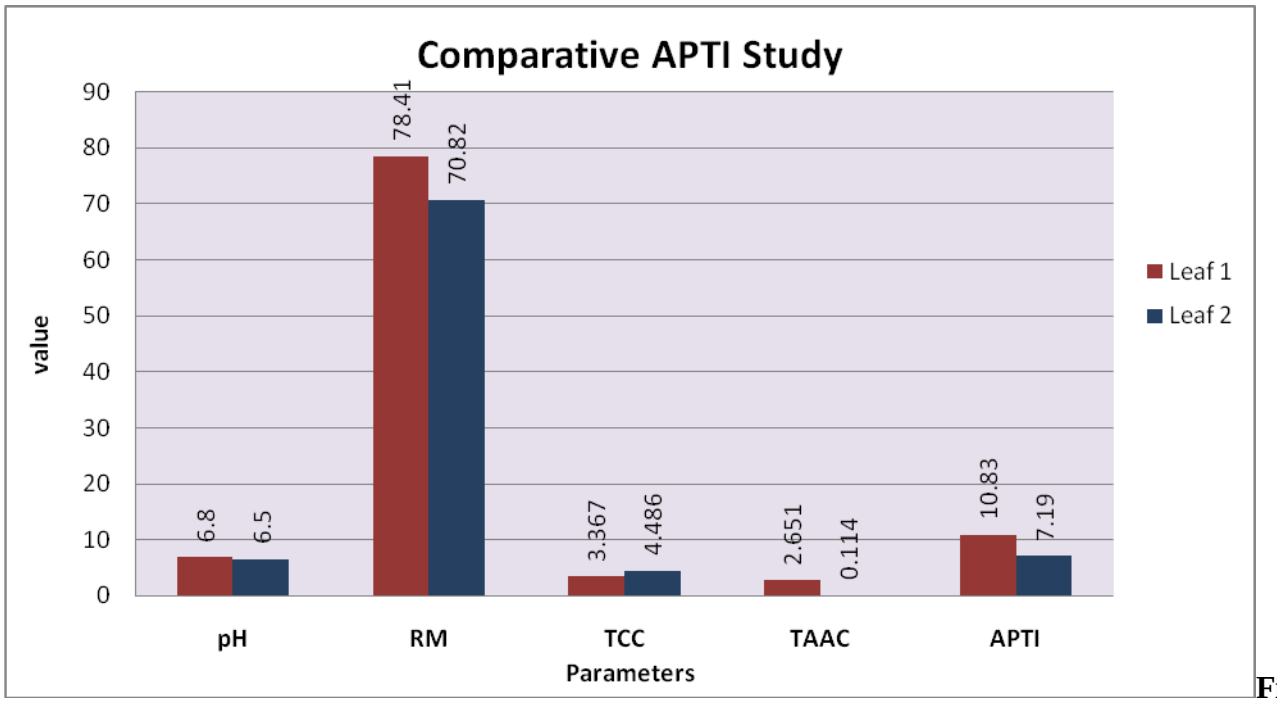

Figure 1: Comparative study of APTI

The pH results was found 6.8 in extract of fresh leaf collected from polluted road side and 6.5 in extract of fresh leaf collected from unpolluted park. Relative water content was found 78.41% in leaf collected from polluted road side and 70.82% in leaf collected from unpolluted park.

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Total chlorophyll content was found 3.367 mg/100 mg in extract of fresh leaf collected from polluted road side and 4.486 mg/100 mg in extract of fresh leaf collected from unpolluted park. Total ascorbic acid was found 2.651 mg/100 mg in leaf collected from polluted road side and 0.114 in mg/100 mg leaf collected from unpolluted park. APTI was found 10.83 at polluted road side and 7.19 at unpolluted park.

CONCLUSION

The Air pollution tolerance index (APTI) was calculated for two leaf samples, one collected from polluted heavy traffic road side and another from a nearby unpolluted park. The study revealed an increase in APTI of the leaves collected from polluted road side than the leaves collected from unpolluted Park. This indicates the tolerance capacity depends on its phytochemical content i.e. pH, relative water content, total chlorophyll content and total ascorbic acid of leaf of plant.

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