Research & Reviews: Journal of Agriculture and Allied Sciences

e-ISSN:2347-226X
p-ISSN:2319-9857

IMPACTS OF AMBIENT AIR POLLUTION ON Mangifera indica GROWING AT PURULIA, PURULIA DISTRICT, W. B., INDIA

MOUMITA SINHA[1], SABYASACHI MUKHOPADHYAY*[2]

[1,2] Department of Environmental Science, Nistarini College, Purulia, W.B. (India)

Research Article

Received date: 18/04/2021
Accepted date: 25/04/2021
Published date: 29/04/2021

***For Correspondence**

SABYASACHI MUKHOPADHYAY

Keywords: Air pollution, Mangifera indica, biochemical characteristics, APTI.

ABSTRACT

In present days, growing industrialization and vehicular traffic are immense threat to ambient air quality in most of the urban areas. Few plants are sensitive and few are tolerant to air pollution in urban as well as in industrial habitats. Purulia have high emission of air pollutants mainly due to contribution of automobile exhaust, small industries, and domestic heating. In the month of February-March of 2019, impact of air pollution on Mango (Mangifera indica) leaves was investigated considering their biochemical characteristics and APTI values. Three samples were sampled considering control (Bongabari) and commercial areas (Renny Road, and Chawk Bazar) investigated by standard methods and APTI was calculated. Highest APTI was observed at control area (i.e., 18.52) followed by 12.79 at Renny Road and 11.54 at Chawk Bazar. It reveals that, between two commercial sampling points in Purulia town, Chawk Bazar shows more remarkable threatened condition.

e-ISSN:2347-226X
p-ISSN:2319-9857

INTRODUCTION

Plants are essential to balance both the nature and people's lives. Green plants, i.e., those possessing chlorophyll, are able to manufacture their own food and give off oxygen in the process of photosynthesis, in which water and carbon dioxide are combined by the energy of light. Plants are the ultimate source of food and metabolic energy for nearly all animals. Besides foods (e.g., grains, fruits, and vegetables), plant products are vital to humans include wood and wood products, fibres, drugs, oils, latex, pigments, and resins. Coal and petroleum are fossil substances of plant origin. Thus plants provide people not only sustenance but shelter, clothing, medicines, fuels, and the raw materials from which numerous other products are made. Pollution is now a common place term that our ears are attuned to. We hear about the various forms of pollution and read about it through the mass media. Irrespective of indoors or outside, air pollution is one such form that refers to the contamination of the air. A physical, biological or chemical alteration to the air in the atmosphere can be termed as pollution which occurs as and when any harmful gases, dust, smoke enters into the atmosphere and makes it difficult to survive for plants, animals and humans as the air becomes dirty. Growing industrialization and vehicular traffic especially in the urban areas of India is a great threat to air quality. The identification and categorization of plants into sensitive and tolerant groups is important because the former can serve as indicators and the latter as sinks for the air pollutants in urban and industrial habitats. Plant selection for their sensitivity or tolerance level to air pollutants is important because the sensitive plants can serve as bio-indicator and the tolerant plants as sink for controlling air pollution in urban and industrial areas. Purulia have high emission of air pollutants, which is degrading the ambient air quality day by day. There is now great concern that air pollutants especially sulfur dioxide, ozone, and oxides of nitrogen can change the physiological processes of plants, thereby affecting patterns of growth. Air pollutants cause damage to leaf cuticles and affect stomata conductance. They can also have direct impacts on photosynthetic systems, leaf longevity, and patterns of carbon allocation within plants. Pollutants interact with other environmental factors, and may change plant-environment relationships on a regional scale (Winner, 1981). Various strategies exist for controlling atmospheric pollution, but vegetation provides one of the natural ways of cleansing the atmosphere by absorption of gaseous and some particulate matter through leaves (Varshney, 1985). Lots of work has been performed to study the response of traffic load on plants (Angold, 1997) and also the impact of industries on plants (Chaphekar, 1972; Dwivedi and Tripathi, 2007). The degradation of air quality is a major environmental issue that affects many urban and industrial areas and the surrounding regions worldwide. On the basis of air pollution indices like adsorption or absorption, different plant groups were classified into sensitive, intermediate, moderately tolerant plant groups (Singh et al., 1991). To screen plants for their sensitivity or tolerance level to air pollutants, large number of plants parameter has been used including leaf or stomatal conductance, ascorbic acid, relative water content, membrane permeability, peroxidase activity, chlorophyll content and leaf extract pH (Choudhary and Rao, 1977; Keller and Schwager, 1977; Sivakumaran and Hall, 1978; Farooq and Beg, 1980; Winner, 1981; Eckert an Houston, 1982; William and Christopher, 1986; Singh et al., 1991; Tripathi et al., 1991; Namita et al., 2009). To indicate the susceptibility level of plant, pollutioninduced changes in individual parameters are usually quantified and correlated with the level of plant response. The combination of the biochemical and physiological parameters gave a more reliable result than those of individual parameter. Therefore, combination of parameters.

MATERIALS AND METHODS

The major sources of pollutants in Purulia town are automobile exhaust, small industries, and domestic heating. Sample, i.e., Mangifera indica leaves, collected from Bongabari (S1as control zone, 3.0 km far from Purulia town); Renny Road (S2), and Chawk Bazar (S3) which are the heart and prime commercial area of the Purulia town, were investigated with respect to their biochemical characteristics and APTI values. For this purpose, the mature leaf samples (fifth from top) of the most common plant in the

e-ISSN:2347-226X
p-ISSN:2319-9857

region such as Mangifera indica (Mango) were collected in the month of February-March, 2019. For each species, five individuals were identified and each sample was taken in triplicate. Care was taken to see that all plants had, as far as possible, the same ecological condition with respect to light, water, soil and pollutant exposure. The collected samples were analyzed for ascorbic acid, chlorophyll; relative water content and leaf extract pH. The mean values of different parameters were used for computing the index. Total chlorophyll content was estimated using the method of Singh et al. (1991). Briefly, for chlorophyll estimation, 200 mg of leaf material directly harvested from the plants was ground in mortar and pestle with a small quantity of acid washed sand in 80% acetone. The absorbance of the filtered extract was measured through spectrophotometer (Genesis 6, Thermo Electron) at 645 nm and 663 nm. Equation 1 was used to calculate total chlorophyll.

$$\text{Total chlorophyll (mg/g)} = \frac{V\,(20.2\times A645 + 8.02\times A663)\times V}{1000\times W}$$

Where, A645 = Absorbance at 645nm; A663 = Absorbance at 663nm; V = Total volume of extract; W = Weight of leaf material in gram

For Ascorbic acid, 0.5 g of fresh leaf sample was homogenized with 20 ml of extracting solution (5 g oxalic acid + 0.75 g EDTA in 1000 ml of distilled water). It was centrifuged for 15 min at 6000xg and the supernatant collected. The supernatant (1 ml) was added to 2,6dichlorophenol indophenol (DCPIP) (5ml of 20 µg/ml), the solution was turning pink. The optical density of the mixture was taken at 520 nm (Es). After taking the optical density (OD) of the mixture one drop of ascorbic acid was added to bleach the pink colour and again the OD was taken at the same wavelength (Et). The OD of DCPIP solution was also taken at 520 nm (Eo). The standard curve was prepared by using different concentration of ascorbic acid by following the same method. Individual leaves of different plant species were excised and weighed immediately. They were dipped into water in a beaker. After 8 hr the leaves were blotted and reweighed before being dried at 80ºC for 24 hr and reweighed. For determination of leaf pH, 5 g of leaf samples was well homogenized with 50 ml deionized water and pH of the suspension was measured with a digital pH meter (Hanna Instrument, Germany).

$$\text{APTI} = \frac{[A\,(T + P)] + R}{10}$$

Where, A is ascorbic acid content of leaf in mg/g dry weight, T is total chlorophyll content of leaf in mg/g dry weight, P is leaf extract pH and R is % relative water content of leaf. The total sum is divided by 10 to obtained APT

RESULTS AND DISCUSSION

Parameter	Control (S1)	S2	S3
Total chlorophyll (mg/g dry weight)	11.98	8.12	4.07
Leaf extract pH	9.4	7.2	7.0
Ascorbic acid (mg/g dry weight)	4.12	3. 28	3.12
Relative water content (%)	89.78	71.35	74.06
APTI	17.26	12.16	10.86

Table-1: Results obtained after analysis

e-ISSN:2347-226X
p-ISSN:2319-9857

From the Table-1, it clear that in Purulia town, there was very serious impacts on plants from the air pollution. In Bongabari, every parameter is in good state, which depict that there was less stress on *Mangifera indica* than in case of Purulia. Between two sampling point in Purulia town, Chawk Bazar shows more threatened figure, which is very remarkable. APTI determinations are of importance because with increased industrialization, there is increasing danger of deforestation due to air pollution. The results of such studies are therefore handy for future planning and may be helpful to bring out possible control measures. It is worth noting that combining a variety of parameters gave a more reliable result than when based on a single biochemical parameter.

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