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STUDY ON EFFECTS OF AIR POLLUTION ON PLANTS AROUND THE VICINITY OF THE INDUSTRIAL AREA HALDWANI

Ecology

Smriti Rawat* Uttarakhand Education Department. India. *Corresponding Author
Asha Tiwari Department of Botany, M.B.P.G. College, Haldwani, Uttarakhand, India.

ABSTRACT

Pollution is the major problem faced globally due to the industrialization. This paper studied the effect of air pollution by Century paper mill on five selected plant species *Aegle marmelos, Ficus benghalensis, Ficus religiosa, Tamarind indica* and *Mangifera indica.* The physiochemical analysis was studies – dust holding capacity, total Chlorophyll, relative water content and pH of leaf extract. Dust holding capacity was highest in *Ficus benghalensis.* Plant showed loss in chlorophyll content and relative water content in polluted site indicated that pollution affects plants internally and also indicates their physiological adjustment with environmental stress. This study suggests that all selected plants are well acclimatized and would be good choice for urban area.

KEYWORDS

effect, air pollution, plant, vicinity, industrial area.

INTRODUCTION

The quality of air is the most alarming issues related to the environment. There is increase in the pollutants which are deteriorating the quality of air that we breathe in. Pollutants from automobiles, industries have created a brown cloud zone over many cities. Chemicals such as sulfur dioxide, fluorides and PAN which are commonly found in air damage the leaves [1]. Green plants have always played a role in determining the status of the environment. Many green plants acts as an environmental indicator (bio indicators)[2]. The air quality is generally described as a combination of the physical and chemical characteristics that make air a healthful resource for human, animal and plants. Air pollutants can directly affect flora and fauna [3]. Plants are the primary and most obvious receptors of a large number of pollutants and the effects of air pollution on plants have been known since a long time. A relationship between traffic density and photosynthetic activity, stomata conductance, total chlorophyll content and leaf senescence has been reported [4].

The present study was undertaken from Century pulp and paper mill in Haldwani city. Due to the mills activity many air pollutants are causing deterioration of air quality. The present study is to find out the level of pollution by dust deposition on leaf surface and other biological changes in the plants with an idea of the selection of pollution tolerant plants for urban area.

MATERIALS AND METHODS

Study area and climate

Lalkuan Haldwani where the Century pulp and paper mill is situated at 29.08° N latitude and 79.52° E longitude 371 m elevation. It has a subtropical, temperate climate with an average annual rainfall of 1699 mm. The study was conducted in year 2019. During study period the predominant wind direction was towards south west to north east. Fully mature leaves from top, middle and basal canopy were collected from each plant species from each site during 7.00 – 8.00 hrs from the vicinity of industry. Control site was located at a distance of 15 km from the industry in the prevailing wind direction. Five tree species namely *Aegle marmelos, Ficus benghalensis, Ficus religiosa, Tamarind indica* and *Mangifera indica* commonly planted in all study sites were selected. The samples were placed into a sealed plastic bag, taken to the laboratory and preserved in refrigerator for analysis.

Lab Analysis of Leaf Samples

Biochemical parameters of the plant such as dust holding capacity, relative water content, total chlorophyll, leaf extract pH, were analyzed in the lab. Dust content was measured by the method of Agrawal and Tiwari (2000)[5]. Chlorophyll content was calculated by the method proposed by Upadhyay and Dwivedi (1979)[6] and relative water content was determine by the method adopted by Weatherly (1950)[7]. The pH of leaf suspension was measured with the help of a pH meter.

RESULTS AND DISCUSSION

The results are obtained given in the Table 1. Dust holding capacity of different plants was recorded different based on their leaf size, structure, height and canopy of the trees. The maximum dust deposition was recorded in *Ficus benghalensis* (23.35 mg/cm²) and minimum in *Aegle marmelos* (1.10 mg/cm²) (Fig-1). Higher dust deposition may be due to hairy, waxy coatings on the leaves with folded margins and rough surfaces. This high dust holding capacity can be attributed to the large surface area, texture of leaf surface for holding the maximum dust particles [8].

The maximum decrease in total chlorophyll was recorded in *Ficus religiosa of 1.89* mg/g and minimum in *Tamarind indica of 0.73* mg/g (Fig-1). The chlorophyll is the essential pigment in plant for food production for the process of photosynthesis. In the present study due to the pollution the reduction in total plant chlorophyll is seen. Sulfur dioxide (SO2), nitrogen oxides and CO2 along with suspended particulate matter, when absorbed by the leaves may cause a reduction in the concentration of photosynthetic pigments like TCH and carotenoides. This may directly affect the plant productivity [9]. Babu et al. [10] observed that all the plants showed lesser values of TCH in polluted site as compared to the control site.

The maximum loss of RWC was recorded in *Mangifera indica* 7.95 % and minimum in *Ficus religiosa* 5.74% (Fig-1). High relative water content in species from polluted sites signifies plants adaptive features for maintaining their life processes during stressed conditions [11, 12] also recorded high RWC under a polluted environment. It indicates that *Ficus religiosa* its tolerance to pollution pressure. The leaf wash suspension pH was recorded maximum 7.6 and 7.1 in polluted and control site and minimum 5.7 and 5.1 in polluted and control site respectively (Table-1). Acidic nature in species from the polluted site could be attributed to the presence of acidic pollutants (especially SO2) in the air, which triggers the manufacture of H+ ions. These ions react with SO2, forming sulfuric acid and eventually reducing leaf pH [13]. It has been reported that a high level of pH increases tolerance capacity [14] thus, *Aegle marmelos and Ficus benghalensis* with neutral pH in polluted site may be tolerant.

Table1 : Effect of pollution on certain characteristic of few tree species

S. No.	Name of the Plant	DHC (mg/cm²)		Total Chl (mg/g)		RWC (%)		pH of leaf	
		C	P	C	P	C	P	C	P
1	*Aegle marmelos*		1.10	8.74	7.57	36.64	30.16	7.15	7.65
2	*Ficus benghalensis*		23.35	3.62	2.61	89.02	82.23	7.17	7.02
3	*Ficus religiosa*		22.15	4.98	3.09	82.08	76.34	5.98	6.35
4	*Mangifera indica*		7.55	8.29	7.11	94.49	86.54	6.68	6.79
5	*Tamarind indica*		1.91	5.91	5.18	73.55	66.93	6.77	5.70

DHC- Dust holding capacity
Chl- Chlorophyll content of leaf
RWC- Relative water content of leaf
C-Control area
P- Polluted area

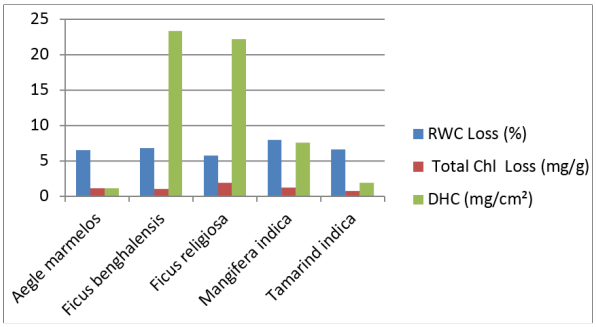

Fig -1 Loss in RWC, Chl and DHC in different plant species in polluted site

CONCLUSION

Pollution changes the biochemical composition of the plant which causes variation in their tolerance capacity against pollution. Dust holding capacity was higher in *Ficus benghalensis and Ficus religiosa.* These selected tree species can control the dust pollution by dust capturing in polluted site. The amount of total chlorophyll is decreased in all plants but in *Tamarind indica and Ficus benghalensis* this reduction was minimum due to their tolerance to the pollution and higher relative water content in *Mangifera indica* indicates that this plants had good resistance and tolerance to air pollution. The neutral pH found in *Aegle marmelos* makes this plant more tolerant against pollution. The present study highlights the selection process of plants which can help in the reduction of dust and air pollution. This study suggests that all selected plants are well acclimatized and would be good choice for urban area or polluted sites.

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