Auto Exhaust Pollution Induced Alteration in Leaf Morphology of Some Common Road Side Plants

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Present paper deals with the Auto exhaust induced changes in leaf morphology of some common road side plants. The study was conducted in city Ghaziabad, three sites were selected- HPA (Highly polluted area), MPA (Medium polluted area), FA (Fresh area). Five plants - ***Ricinus communis*** *(Arandi),* ***Amaranthus viridis*** *(chauli),* ***Cassia obtusifolia*** *(chakunda),* ***Withania somnifera*** *(ashvagandha),* ***Calotropis procera*** *(madar). The parameters examined were leaf length, breadth and area. Decline was recorded in the parameters considered for the study of the leaf samples collected from polluted areas. These alterations can be considered as indicators of auto exhaust pollution.*

Keywords: Auto exhaust, Leaf morphology, Highly polluted area (HPA), Medium polluted area MPA, Fresh area (FA).

1. INTRODUCTION

The mad race among the nations over the globe for development jeopardizes the health of man himself. Progress in agriculture, transportation and industry is taken as general criterion of development of any country. Automobiles are need of modern world and are one of the major sources of environmental pollution and cause health hazards to dangerous level. The ever increasing vehicular traffic density posed continued threat to ambient air quality and taking most of cities in the grip of auto exhaust pollution. According to an estimate automobile fleet of the country emits over 1.8 million tones of air pollutants, of which more than 80% are released in cities [1]. The response of plants to pollutants is variable and depends on the individual genotype, age, stage of growth, proximity and concentration of pollutants. Leaf is the most sensitive part of the plant which is most affected by air pollution in comparison to root and stem. Therefore, at its various stages of development, serves as good indicator of air pollution. Air pollution due to vehicular emission introduces several pollutants – oxides of nitrogen & sulphur, hydrocarbons, particulate matter etc. into environment. Research studies reveal that plants growing in urban areas are affected greatly by these pollutants [2,3]. Different plants react differently to the stress of auto vehicular emission [4]. All the plants are equally important, as they are integral part of biodiversity that is why for present study five common roadside plants were selected.

2. METHODOLOGY

The plants selected for present study were **– *Ricinus communis*** (Arandi), ***Amaranthus viridis*** (Chauli), ***Cassia obtusifolia*** (Chakunda), ***Withania somnifera***

(Ashvaghanda) and ***Calotropis procera*** (Madar). Three sites were selected for the present study i.e. HPA (Highly Polluted Area), MPA (Medium Polluted Area) and FA (Fresh Area). Twenty five leaves per plant per site were selected and length & breadth were measured with help of simple scale. Area was calculated by drawing outline on graph paper and counting squares of it.

3. RESULTS AND DISCUSSION

Observations are presented in Table 1 and reduction values are shown in Figure 1, 2, and 3. Leaf length showed reduction of 8.58%, 6.25%, 8.29%, 15.33% and 17.01% in leaves of ***Ricinus communis, Amaranthus viridis, Cassia obtusifolia, Withania somnifera and Calotropis procera,*** respectively, collected from MPA site, but decline was more drastic at HPA site i.e. 20.96%, 8.02%, 20.12%, 27.68% & 22.82%, In ***Ricinus communis, Amaranthus viridis, Cassia obtusifolia, Withania somnifera*** and ***Calotropis procera,*** respectively.

Table 1: Effect of auto exhaust pollution on leaf morphology of selected plants.

PLANT	SITES	LENGTH (cm)	BREADTH (cm)	AREA (cm^2)
Ricinus communis	FA	12.93±0.45	09.38±0.42	53.40±2.49
	MPA	11.82±0.41	09.00±0.40	50.32±2.00
	HPA	10.22±0.42	08.32±0.30	46.95±1.67
Amaranthus viridis	FA	09.60±0.41	04.04±0.02	18.00±1.02
	MPA	09.00±0.40	03.90±0.20	15.54±0.84
	HPA	08.83±0.51	03.34±0.02	12.13±0.53
Cassia obtusifolia	FA	04.82±0.32	02.98±0.12	10.94±1.02
	MPA	04.42±0.30	02.45±0.12	08.03±0.82
	HPA	03.85±0.21	02.17±0.22	06.14±0.32
Withania somnifera	FA	14.41±0.02	04.53±0.23	72.04±3.05
	MPA	12.20±1.25	03.85±0.20	60.58±2.82
	HPA	10.42±1.02	03.52±0.23	51.10±2.01
Colotropis procera	FA	12.58±1.20	08.54±0.56	83.86±7.66
	MPA	10.44±0.85	07.39±0.53	58.05±5.80
	HPA	09.71±0.76	06.86±0.44	51.09±4.03

Values are mean of 25 reading with ±S.E.

Like length, breadth also showed decline at MPA site i.e. 4.05%, 3.46%, 17.78%, 15.01% and 13.46% in ***Ricinus communis, Amaranthus viridis, Cassia obtusifolia, Withania somnifera*** and ***Calotropis procera,*** respectively. Decline was also recorded in leaf breadth at HPA site i.e. 11.30% (***Ricinus communis),*** 17.32% ***(Amaranthus viridis),*** 27.18% ***(Cassia obtusifolia),*** 22.29***% (Withania somnifera)*** and 19.67% ***(Calotropis procera).***

Reduced length and breadth of leaves in polluted site samples, resulted in reduced leaf area at MPA site i.e. 5.77% (***Ricinus communis),*** 13.67% ***(Amaranthus viridis),*** 26.59% ***(Cassia obtusifolia),*** 15.90***% (Withania somnifera)*** and 30.78% ***(Calotropis procera),*** but reductions were more drastic at HPA site i.e. 12.07%, 32.61%, 43.87%, 29.06% & 39.08% in ***Ricinus communis, Amaranthus viridis, Cassia obtusifolia, Withania somnifera*** and ***Calotropis procera,*** respectively. After comparing values of all the plants selected for investigation, it was found that maximum reduction in length (17.01%), breadth (17.78%) and area (30.78%) were noted in ***Calotropis, Cassia*** and ***Calotropis,*** respectively, at MPA site. However, at HPA site maximum reduction of length (27.68%), breadth (27.18%) & area (43.87%) were found in ***Withania*** and ***Cassia*** (breadth & area), respectively.

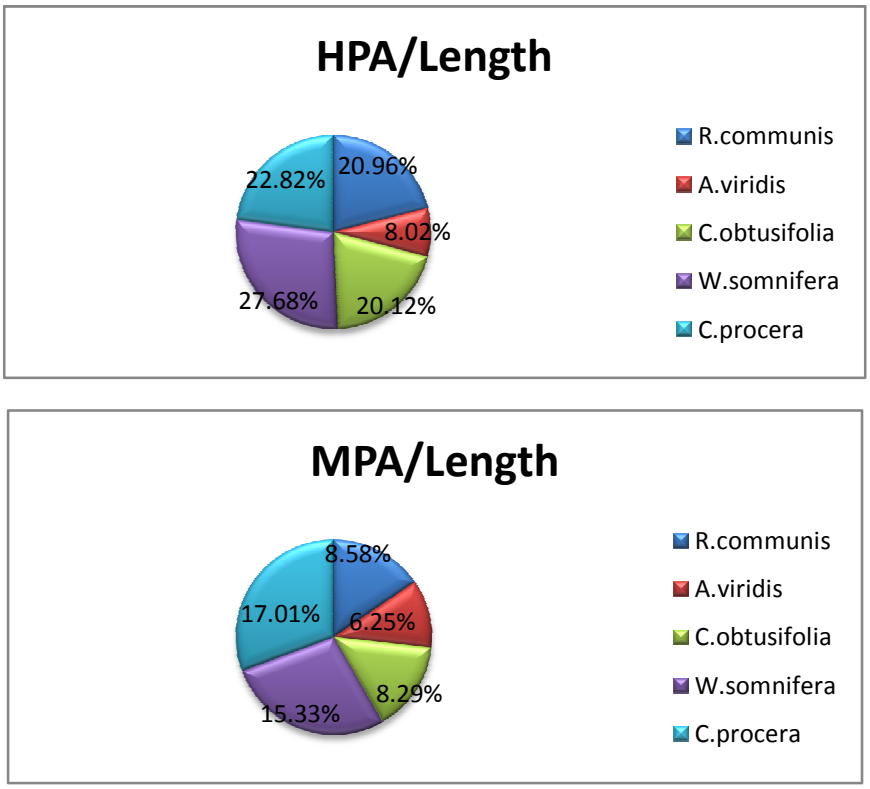

Fig. 1: Overall decreased % leaf length of selected plants in polluted samples with respect to fresh area.

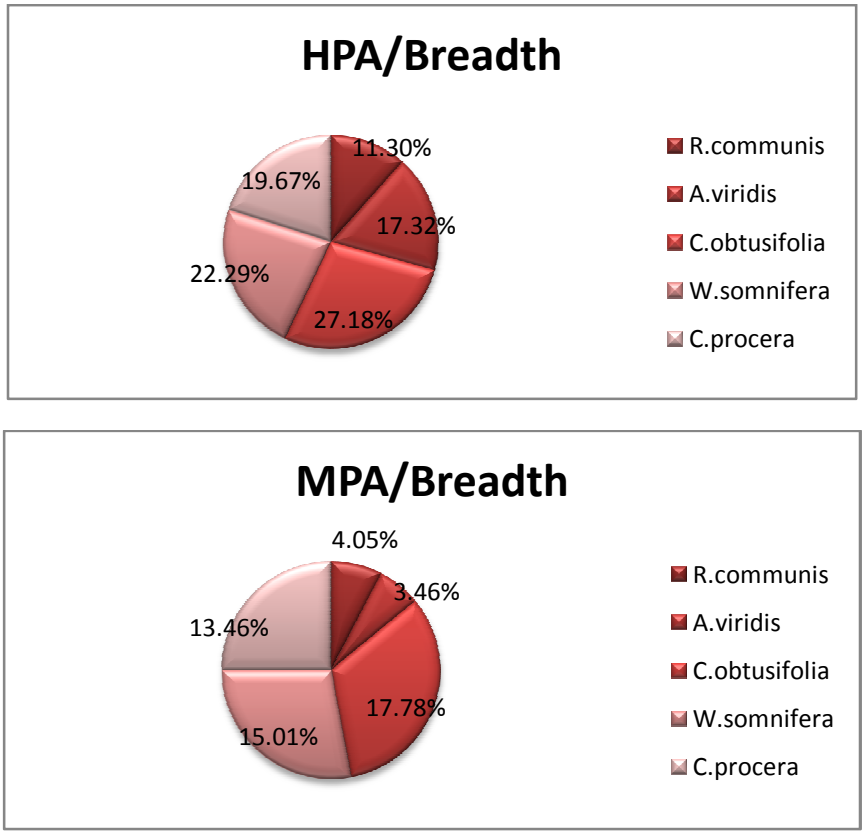

Fig. 2: Overall decreased % leaf breadth of selected plants in polluted samples with respect to fresh area.

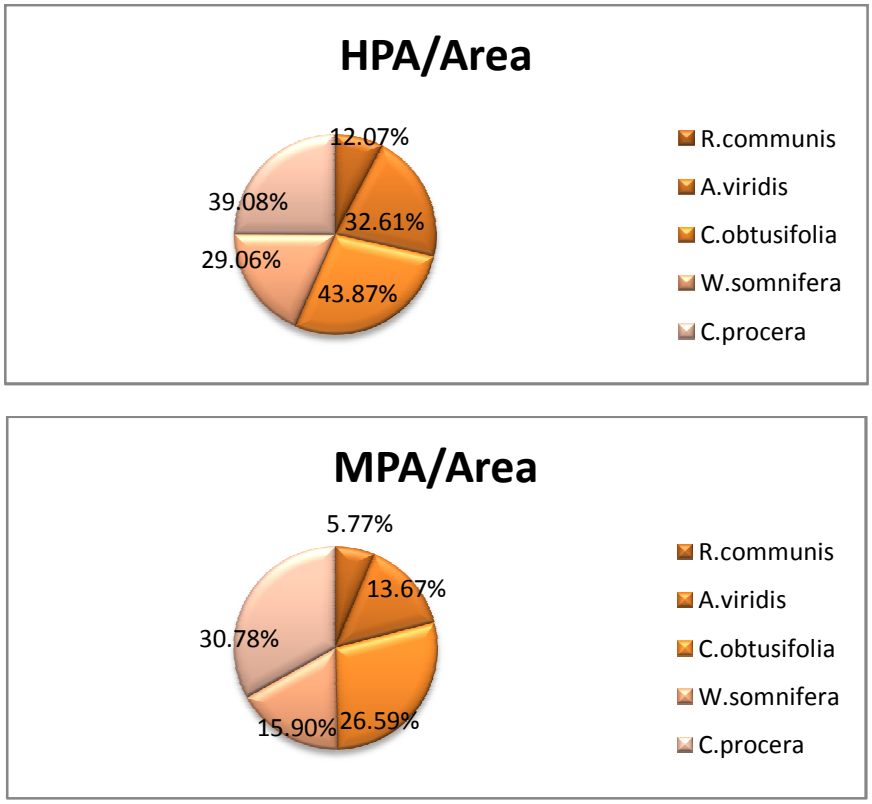

Fig. 3: Overall decreased % leaf area of selected plants in polluted samples with respect to fresh area.

Snehlata *et al.* also reported decline in length, breadth and area in the leaves of ***Datura alba*** collected from road side area [5]. Reduction in leaf area at vehicular polluted site might be due to more amount of damaging pollutant like sulphur dioxide & oxide of nitrogen in ambient air emitted by various automobile, which affect the cell elongation mechanism and photosynthetic capacity of the leaves [6-10]. Sodnik *et al.* [11] reported reduction in leaf blade in five tree species growing in the vicinity of heavy dust and sulphur dioxide. Aggarwal *et al.* [12] also reported reduction in leaf area as well as photosynthetic pigments. In plants leaf is the important organ and it remain in contact with atmosphere and the stomata provide the route for the entry of various pollutant into the mesophyll cells, which adversely affect the size and structure of leaflet. Efe *et al.* [13] suggested that leaf dimensions viz. leaf area, leaf length, leaf breadth were reduced as an adaptation to survive under auto exhaust pollution.

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