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Effect of Auto Exhaust Emission on The Morphology of Some Common Weeds along NH-58 in Wesrtern Uttar Pradesh

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ABSTRACT

Auto exhausts emission posing a serious threat to modern society and plants as well.Present paper deals with effect of vehicular emission on the morphological attributes of some common weeds namely *Abutilon indicum* and *Calotropis procera* growing alongside N H 58 in western Uttar Pradesh. Investigation of some morphological characteristics of selected plant species growing at Meerut cantonment, Khatauli bypass and Muzaffarnagar bypass was done in three different seasons and compared with the same plants species growing in control sites. Significant reductions were recorded in the length and breadth of leaves, leaf area and length of petiole(leaves in *Calotropis Procera* are sessile. Present reduction in studied parameters was found to be maximum in winter season at Meerut cantonment site. The alteration in morphological attributes could be an adaptation to minimize the impact of vehicular pollution.

Key words: Auto exhaust, morphology, leaf area, reduction.

INTRODUCTION

Auto exhausts emission becoming a major challenge day by day due to ever increasing. According to National Academy of Science, USA (1966), pollution is defined as "An undesirable change in physical, chemical and biological characteristics of water, air and soil that may harmfully affect human, animal and plant life, industrial progress, living conditions and cultural assets." While pollutants may be defined as any form of energy or matter or action that causes imbalance or disequilibrium in the required composition of natural objects such as air and water etc. A pollutant creates damage by entering directly or indirectly with the biochemical process of organisms eg. Vehicular pollutions in plants.

Pollution is viewed as *'an unfavourable alteration*' on the sustaining and carrying capacity of natural environment wholly or largely due to byproducts of human activities. Natural environment has an inbuilt capacity to replenish or to repair the losses or reduction in its constituents to restore it as sustainable and healthy as required.

Monitoring of these air pollutants arising from automobile is a prerequisite to air quality control. The impact of these pollutants on plant health is often used as indicator of and a tool for monitoring environmental pollution (**Rao**, 1977; **Posthumus**, 1984, 85; **Agarwal** and

Agarwal, 1989; **Kulump***et.al.* 1994; **Dmuchoski** and **Bytherowicz**, 1995).NH- 58 connects National Capital to various tourists destinations located in western parts of India such as Himachal Pradesh, Uttarakhand, Jammu and Kashmir. Thus the traffic load throughout the year remains very high, resulting in the roadside plants are under continuous environmental stress due to vehicular pollutions. It is estimated that in India about a million tons of pollutants are being released into the atmosphere everyday and out of which about 75% contribution is from automobiles alone (Chauhan, 2004).

Salgare *et. al.* (1989) studied the effects of auto-exhaust pollutant on the morphology of some trees. Johri *et. al*., 2000 and Snehlata *et. al*., 2000 studied the leaf morphology and categorize the road side plants as comparatively more resistant (*Azadirachta indica* and *Datura* sps.) and more sensitive (*Cassia fistula*, *Solanum nigrum* and *Withania somnifera*) to auto exhaust pollution. Bhati and Iqbal (1988) found significant decline in leaf length of *Ficus bengalensis* at the polluted sites.

MATERIAL AND METHOD

The following two angiosperm shrubs which are commonly grown along NH-58, Meerut to Muzaffarnagar have been selected for the present study:

1. *Abutilon indicum* (L.) (Malvaceae)
2. *Calotropis procera* (L.) (Apocynaceae).

On this highway three polluted sites were selected in western Uttar Pradesh: Meerut Cantonment, Khatauli bypass and Muzaffarnagar bypass.

To assess the effect of vehicular pollution on angiosperms the following parameters were studied.

1. Selection of Site
2. Selection of Plants
3. Collection of Sample

(1) Morphological Studies:

The following morphological attributes were examined. Quantitative characters of the leaves such as:

(a) **Specific leaf area** (mm^2) was measured with the help of graph paper and leaf area meter, both at polluted site and controlled sites.

(b) Leaves width were measured.

(c) Leaves length were measure

(d) Length of petiole were measured

LEAF MORPHOLOGY:

When all the morphological attributes of leaves of pollution affected plants were compared with control sites, the length, breadth and leaf area, showed reduction in both plants selected for the present investigation (table 1-2 and fig. 1-2).

Length of leaf has showed percent reduction by22.49, 21.80 and 22.26 percent in *Abutilon indicum* and 14.36, 14.24 and 14.30 percent in *Calotropis procera* during summer season on plants growing at Meerut Cantonment, Khatauli bypass and Muzaffarnagar bypass respectively along NH 58.

Observation made during winter season showed decrease in leaf length maximum. Percent reduction was 23.10, 22.28 and 22.90 in *Abutilon indicum* and 15.10, 14.80 and 15.06 in *Calotropis procera* collected from Meerut Cantonment, Khatauli bypass and Muzaffarnagar bypass respectively. The leaf breadth under polluted conditions also showed reduction in all the three seasons in all selected plants. Percent reduction was 25.14, 24.64 and 25.61 in *Abutilon indicum* and 14.89, 13.46 and 15.30 in*Calotropis procera*during summer season collected from Meerut Cantonment, Khatauli bypass and Muzaffarnagar bypass respectively.

Observations made during rainy season showed percent decrease in breadth of leaf was 21.10 in *Abutilon indicum* and 14.24, 13.82 and 14.18 in *Calotropis procera* collected from Meerut Cantonment, Khatauli bypass and Muzaffarnagar respectively.

In winter season percent reduction in breadth of leaf was 28.12, 27.76 and 28.06 in *Abutilon indicum* and 16.45, 15.26 and 16.22 in *Calotropis procera* collected from Meerut Cantonment, Khatauli bypass and Muzaffarnagar respectively.

As a result of decrease in length and breadth of leaves at polluted sites leaf areas of experimental plants also reduced. Observations during summer season percent reduction in leaf area were 30.30, 29.10 and 30.21 in *Abutilon indicum* and 22.94, 20.76 and 22.84 in *Calotropis procera* in samples collected from Meerut Cantonment, Khatauli bypass and Muzaffarnagar bypass respectively.

Observation during rainy season shown percent reduction in leaf area of 22.23, 20.64 and 22.86 in *Abutilon indicum* and 13.24, 12.60 and 13.18 in *Calotropis procera* collected from Meerut Cantonment, Khatauli bypass and Muaffarnagar bypass respectively.

Leaf area of experimental plants reduced more drastically during winter season. The percent reduction in leaf area was 32.10, 30.61 and 32.09 in *Abutilon indicum* and 24.82, 24.10 and 24.77 in *Calotropis procera* samples collected from Meerut Cantonment, Khatauli bypass and Muzaffarnagar respectively.

During summer season length of petiole percentdecrease in*Abutilon indicum* by 25.76, 24.56 and 25.52, samples collected from Meerut Cantonment, Khatauli bypass and Muzaffarnagar bypass respectively.

In winter season the percent increase in petiole was decrease in *Abutilon indicum*27.48, 26.99 and 27.39 percent samples collected from Meerut Cantonment, Khatauli bypass and Muzaffarnagar respectively.

Table-1: Changes in length of leaf (cm), breadth of leaf (cm), leaf area (cm²) and length of petiole of *Abutilon indicum* alongside NH 58 due to vehicular emission in different seasons.

S.No.	Site	Season	Parameters			
			Length of Leaf	Breadth of Leaf	Leaf area	Length of Petiole
1.	Control	Summer	6.89 ± 0.391	6.18 ± 0.238	49.321 ± 2.237	6.155 ± 0.405
		Rainy	7.62 ± 0.380	7.67 ± 0.347	52.289 ± 3.391	6.782 ± 0.348
		Winter	6.67 ± 0.631	6.46 ± 0.803	49.008 ± 2.809	5.086 ± 0.447
2.	Meerut Cantonment (P_1)	Summer	5.27 ± 0.481	4.55 ± 0.670	41.524 ± 3.632	4.695 ± 0.320
		Rainy	6.18 ± 0.321	6.27 ± 0.321	43.340 ± 2.329	5.087 ± 0.172
		Winter	5.10 ± 0.671*	4.42 ± 0.480*	41.037 ± 2.407*	4.536 ± 0.128*
3.	Khatauli Bypass (P_2)	Summer	5.82 ± 0.821	4.70 ± 0.801	42.642 ± 2.322	4.981 ± 0.161
		Rainy	6.43 ± 0.304	6.10 ± 0.327	45.342 ± 2.639	5.281 ± 0.373
		Winter	5.66 ± 0.701	4.60 ± 0.287	42.089 ± 3.809	4.678 ± 0.628
4.	Muzaffarnagar Bypass (P_3)	Summer	5.42 ± 0.231	4.32 ± 0.891	41.583 ± 2.892	4.446 ± 0.307
		Rainy	6.24 ± 0.478	6.18 ± 0.347	43.672 ± 2.679	5.038 ± 0.266
		Winter	5.62 ± 0.740*	4.23 ± 0.282*	41.084 ± 3.725*	4.089 ± 0.407*

Value are in mean, ± standard error (SE) in the column superscript are significantly different at (*) P≤ 0.05.

Table-2: Changes in length of leaf (cm), breadth of leaf (cm), leaf area (cm²) and length of petiole of *Calotropis procera* alongside NH 58 due to vehicular emission in different seasons.

S.No.	Site	Season	Parameters			
			Length of Leaf	Breadth of Leaf	Leaf area	Length of Petiole
1.	Control	Summer	13.58 ± 2.13	8.31 ± 2.41	71.64 ± 3.27	**
		Rainy	14.63 ± 1.64	10.47 ± 3.09	73.91 ± 6.21	**
		Winter	12.74 ± 2.09	8.49 ± 2.86	71.67 ± 4.64	**
2.	Meerut Cantonment (P_1)	Summer	11.62 ± 3.60	6.64 ± 3.09	57.64 ± 4.31	**
		Rainy	12.46 ± 2.91	7.73 ± 2.18	63.08 ± 5.67	**
		Winter	11.32 ± 1.86*	6.32 ± 1.09*	55.72 ± 3.36*	**
3.	Khatauli Bypass (P_2)	Summer	11.78 ± 1.37	6.84 ± 1.92	58.92 ± 3.41	**
		Rainy	12.36 ± 3.21	7.19 ± 2.34	65.80 ± 6.67	**
		Winter	11.40 ± 2.64	6.44 ± 6.68	56.34 ± 4.46	**
4.	Muzaffarnagar Bypass (P_3)	Summer	11.72 ± 2.60	6.56 ± 3.27	57.95 ± 3.38	**
		Rainy	12.40 ± 3.42	7.71 ± 1.69	64.32 ± 4.47	**
		Winter	11.36 ± 4.62	6.36 ± 2.76*	56.14 ± 4.09	**

Value are in mean, ± standard error (SE) in the column superscript are significantly different at (*) P ≤ 0.05.
**** Absent**

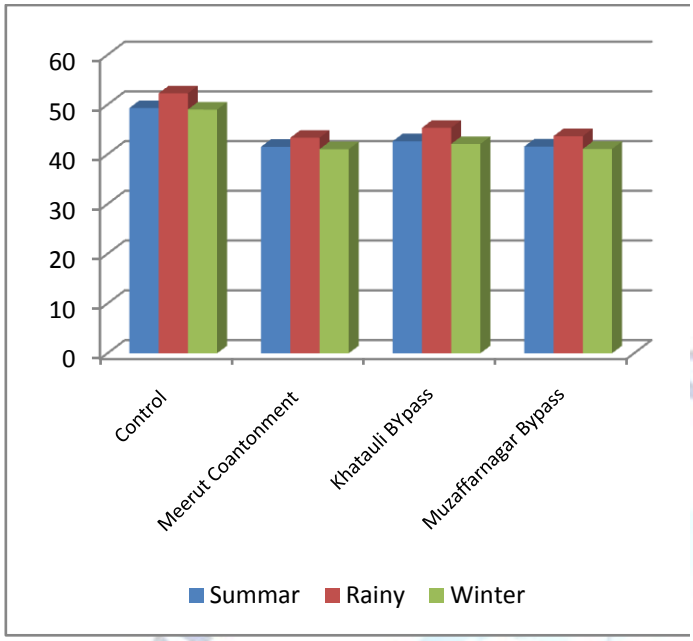

Fig.1 Variationin Leaf area of *Abutilon indicum*

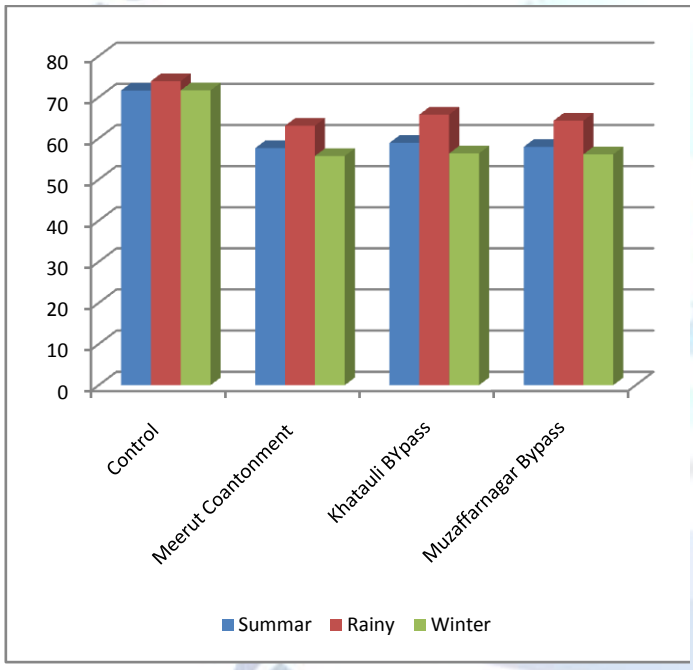

Fig. 2 Variation in leaf area of*Calotropisprocera*

RESULT AND DISCUSSION

To study the effect of vehicular pollution on the morphology of plants growing alongside NH 58, the length, breadth, surface area and petiole of leaves of experimental plants were measured and compared with the plants of control site.

It was observed that leaves collected from polluted sites showed reduction in measurement in all the parameters investigated.Maximum reduction in leaf length, breadth and leaf area was observed at Meerut Cantonment (P_1) followed by Muzaffarnagar bypass (P_2) and Khatauli bypass (P_3) because higher concentration of pollutants at site P_1.**Sadnik** (1987) also recorded reduction in leaf area and size of petiole of plants growing in the vicinity of heavy dust and sulphur dioxide pollution. These observations are in compliance with many workers (**Sharma***et. al.*, **Hrynkiewiez***et. al.* 1987; **Salgare** and **Thorat**, 1995; **Snehlata***et. al.*, 2000) and **Verma** and **Agarwal** (2001).These alterations in morphological attributes could be an adaptation to minimize or resist the impact of auto exhaust pollution.

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