



Short Communication

Foliar Response of Two Species of Cassia to Heavy Air Pollution Load at Indore City, India

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Abstract

Plants are constantly exposed to air, they absorb, accumulate and integrate pollutants confining on their foliar surfaces and show specific response too. The use of plants as monitors of air pollution has long been established, as plants are the initial acceptors of air pollution. Present study was carried out to find out the effect of air pollutants on morphology, physiology and biochemistry of *Cassia siamea* Lamk. and *Cassia glauca* Lamk growing at two different sites of Indore city viz. Scheme No. 78 (Site-I), considered as Low Polluted Area (LPA), in this area there is very low traffic frequency and industries are absent and MR-10 (Site-II) which is Major Road No. 10 of Indore city. There are large number of Industries and heavy traffic frequency in this area, so it is considered as a polluted area. The two species growing at polluted site showed reduction in size of leaf, number of stomata and leaf biomass. Variations in biochemical parameters like chlorophyll in the leaves were found to be pollution load dependent.

Keywords: Ethno air pollution, low polluted area (LPA), heavy polluted area (HPA), foliar morphology.

Introduction

Pollution has posed a very vital question for our survival as we are continuously altering the environment to satisfy our needs. Unplanned industrialization, faster means of transportation, urbanization and ruthless exploitation of natural resources have caused severe environmental crisis by polluting air, water and soil. Air pollution on morphology, physiology and biochemistry of plants. Leaf is the plant part which is most sensitive and constantly exposed to air pollution. The pollution indicator value of the leaf has been studied by a large number of workers¹.

Material and Methods

Indore, the biggest city and commercial capital of Madhya Pradesh is credited to have very dense population, highest growth rate, heavy vehicular density and many industries. Thus having large amount of pollutants which deteriorate the quality of ambient air. Plants being constantly exposed to polluted environment absorb and accumulate pollutants, impinging on their leaf surface. Damaging effects of air pollutants on plants have long been recognized and are therefore used as indicators. Two species of Cassia viz. *Cassia siamea* Lamk and *Cassia glauca* Lamk. Were studied for their response to a mixture of air pollutants in a heavily polluted area of Indore city in October 2008-January 2009.

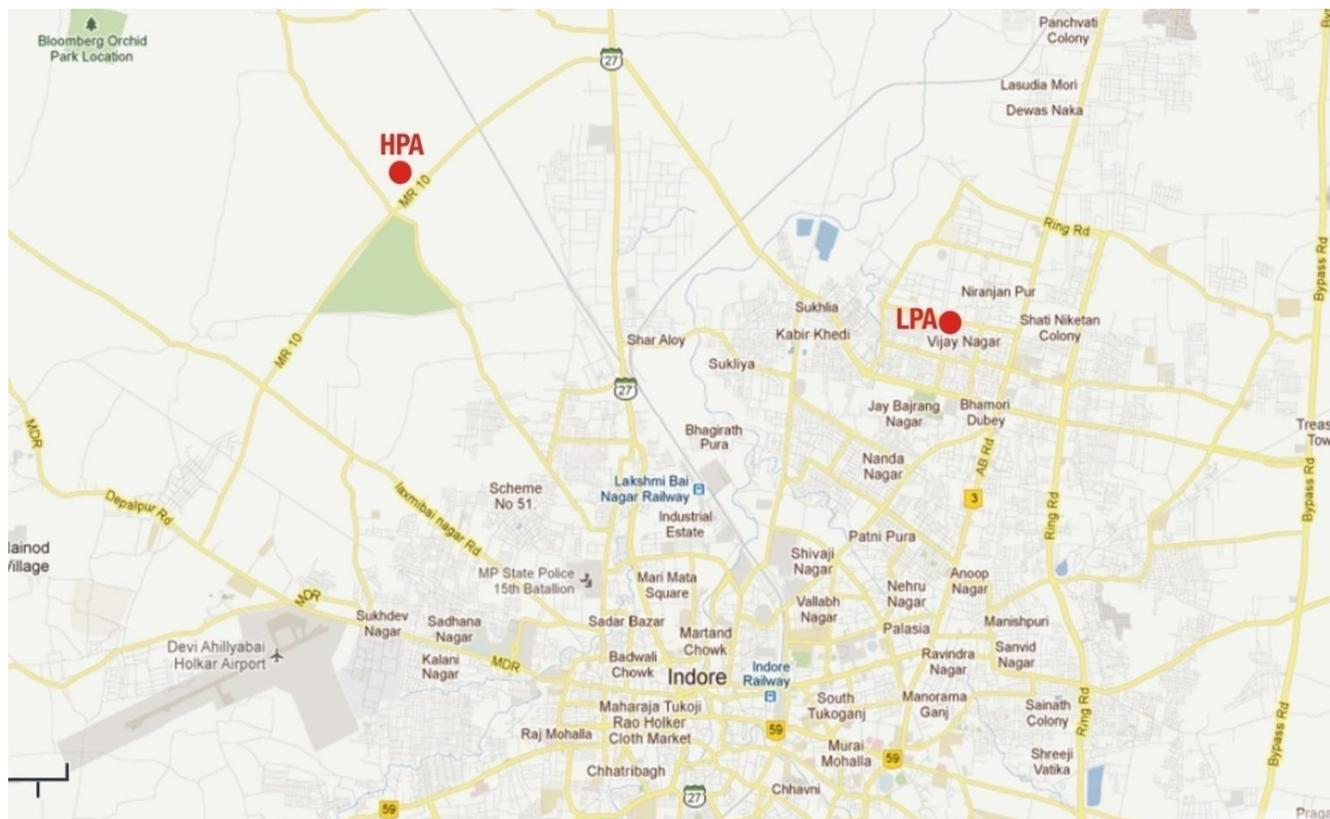
Cassia Siamea Lamk: It is evergreen tree, 10-20m. tall, Leaves pinnately compound 10-25 cm. long, rachis pubescent. Leaflets 6-14 pairs ovate-oblong. In Cassia

siamea Lamk very few stomata are present on abaxial surface and large no. of stomata are present on adaxial surface.

Cassia glauca Lamk: It is deciduous tree 5-10m. tall, Leaves pinnately compound 10-25 cm. long rachis thinly pubescent. Leaflets 4-9 pairs ovate to oblong, large no. of stomata are present on abaxial surface and adaxial surface.

The study was conducted at two sampling stations of Indore city viz. Site-1 (Scheme No. 78), considered as low polluted area (LPA), in this area there is very low traffic frequency and industries are absent. This area was taken as reference site. Site-2 (MR-10) which is major road no. 10 of Indore city, 8.71 km. long, runs from Vijay Nagar via Sukhliya to Sanwer and joins Ujjain City road, taken as a polluted site due to large number of Industries (textiles and fabrics, pharmaceutical Industry, steel re-rolling mills, fertilizer and Chemical Industry etc.). Heavy traffic frequency in this area further added to the pollution load.

Leaf Samples were collected from both the sampling station during study period in polybags from the height of 3-4 meter, kept in cool kit and brought to the laboratory. Fresh and dry weight of the samples was recorded with the help of digital pan balance (Keroy, K-200). The leaf area was measured by planimeter. Number and size of stomata were measured with the help of ocular and stage micrometer and stomatal index was calculated as per Salisbury. The dust deposition of leaf surface was calculated by dry technique of Das and pattanayak, pH and conductivity of leaf extract was recorded with the help of digital pH meter and conductivity meter.



Chlorophyll and carotenoid content were estimated following Arnon (1949) and Duxbury and Yentsc (1956) respectively.

Results and Discussion

The present study on two species of *Cassia* growing at two different sites in Indore city indicates that air pollution causes significant changes in foliar morphology.

Considerable reduction in fresh and dry weight of leaf was observed in both the species. More reduction in dry weight of leaf was recorded in *Cassia glauca* Lamk. Than in *Cassia siamea* Lamk. at polluted site. Marked reduction in leaf area, L/B ratio and L/D ratio was recorded in *Cassia glauca* Lamk than *Cassia siamea* Lamk. Similar Reduction in leaf area of *Cassia siamea*, *Azadirachta indica* and *Dalbergia sissoo* due to SPM has been reported by² Size of stomata and stomatal index was found to be reduced in both the species growing at polluted site. More reduction is stomatal size and index was observed in *Cassia glauca* than in *Cassia siamea*. Reduction in stomatal size due to air pollution⁵. Low stomatal frequency has been observed^{6,1} in response to polluted air.

Heavy dust deposition was observed in both the plant species at polluted site. Maximum dust deposition was found in *Cassia siamea* Lamk. Deleterious effect of dust on the morphology of leaves as expressed by the reduction is size,

necrosis, damaged leaf margin and change of colour.⁷ PH of leaf wash and leaf extract was found to be acidic in both the species at polluted site. Conductivity of Leaf wash and extract was more at polluted site.

The result clearly indicated entry of noxious gases like SO_x and NO_x through cuticle and stomata. Thus altering the pH of leaf surface and that of extract, which is highly damaging and is primary cause of reduction in chlorophyll contents.

Total chlorophyll, carotenoid content of both the species were reduced at polluted site, maximum reduction was found in *cassia siamea* Lamk. Reduction in chlorophyll contents due to air pollutants such as SO_x, NO_x, and CO has been reported by many earlier workers^{8,9,10}.

Conclusion

It is evident from the present study that the air pollutants such as SPM, SO_x, NO_x and gl.O₃ from automobile exhaust and industries along with many other unknown pollutants are responsible for bad air quality. These pollutants not only affect the morphology of plants but also alter the physiology and biochemistry. Reduction in various parameters of two plant species studied at two sites clearly indicates the deleterious effect of air pollution on plant health.

Table-1
Average fresh and dry weight of 50 leaves (gm.), L/B ratio, L/D ratio, area of leaf (cm²), Stomatal size (µm) and stomatal index of leaves of *Cassia siamea* Lamk. And *Cassia glauca* Lamk. Collected from two study area of Indore city in October 2008- January 2009

S. No.	Parameter	<i>Cassia siamea</i> Lamk.		<i>Cassia glauca</i> Lamk	
		Site-1(LPA)	Site-2(HPA)	Site-1(LPA)	Site-2(HPA)
1.	Fresh weight of Leaves	71.75±0.359	62.89±0.354 (12.35%)	50.47±0.590	43.98±0.277 (12.84%)
2.	Dry weight of Leaves	30.36±0.147	28.58±0.118 (5.86%)	17.37±0.210	15.11±0.058 (13.01%)
3.	Leaf area	1638±4.121	1088±4.005 (33.59%)	1183±8.921	688±3.631 (41.80%)
4.	L/B ratio	109±0.532	87±0.322 (20.37%)	101±0.300	65±0.162 (32.55%)
5.	L/D ratio	6289±23.87	5079±21.56 (19.23%)	4715±20.69	3095±23.57 (34.35%)
6.	Size of stomata	100.1	72.3 (27.77%)	98.9	68.4 (30.83%)
7.	Stomatal index (abaxial surface)	32.53	20.98	28.84	19.8
8.	Stomatal index (adaxial surface)	34.19	22.53	30.18	18.35

Table - 2
Dust deposition (mg/cm²), Leaf pH and Conductivity (µmhos/cm²) of leaves *Cassia siamea* Lamk and *Cassia glauca* Lamk collected from two different areas of Indore City in October 2008- January 2009

S. No.	Parameters	<i>Cassia siamea</i> Lamk		<i>Cassia glauca</i> Lamk.	
		Site-1(LPA)	Site-2(HPA)	Site-1(LPA)	Site-2(HPA)
1	Leaf Wash pH	7.5	6.0	7.4	5.9
2	Leaf Wash conductivity	68	198	55	95
3	Leaf extract – pH	7.0	5.2	6.7	6.0
4	Leaf extract-conductivity	79	122	69	192

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