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CORRESPONDANCE

EFFECTS OF URBAN AIR POLLUTION ON FOLIAR PROTEIN CONTENTS IN SOME PLANTS AT INDORE

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ABSTRACT

The present study was conducted in summer, winter and rainy seasons, to assess the impact of urban air-pollution on foliar protein contents of some plants growing in differently polluted areas of Indore city. Results were compared with control/reference area. The protein content showed a mixed response (decreasing and increasing) in different plants in different areas and seasons.

Keywords : Air-pollution, Pollution stress, Pollutants, Metabolism, Foliar-protein.

Introduction

Many phytochemical changes occur in plants under pollution stress, like change in enzyme activity, interference with respiration, photosynthesis, Lipid biosynthesis and protein metabolism. Alteration in protein metabolism has been reported by Leone and Brennan 1972; Nandi et.al. 1980; Sardi 1981; Sicodiya and Bedi 1986; Wegela 1998, Bhupinder Dhir et. al. 1999 and and Chauhan et. al. 2012 Considering various alteration in plant metabolism under pollution stresses. The present study was carried out to understand and analyze the effects of pollutants on foliar protein contents of few plants growing in different areas of Indore city experiencing variable nature and concentration of pollutants.

Indore city is being highly industrialized and densely populated with heavy city vehicular traffic. So plants growing in and around Indore city are thus exposed to a variety of pollutants such as SO_2, NO_x and SPM.

Material and Method

Mature leaves of *Azadirachta indica* Linn, *Bauhinia variegate* Linn, *Cassia fistula* Linn, *Cassia siamea* Lamk, *Dalbergia Sissoo* L, *Eucalyptus* hydrid, *Syzygium cumini* Lam, *Ficus religiosa* and *Mangifera indica*, were sampaled from the height of 3-4 meters and in case of *Clerodendrum inerme* from o1 to 01.5 meter from ground level. Sampling was done in morning hours (between 8 to 10 AM) during winter, summer and rainy seasons of the year 2010 Leaf samples were collected in 3 replicates from road side, industrial and textile mill areas as autoexhaust, industrial and coal wood burning emissions prevail respectively in the areas (Plat 01). Samples collected from Residence area served as unaffected /control or reference. Plants of approximately same age were selected for sampling. All the samples were brought to the laboratory in polythene bags enclosed in ice box containing ice. Samples were washed with distilled water and then cut into small pieces and mixed properly to get a composite sample for

Table 01 – Protein Content (mg g^{-1} fr.wt.) of plants growing in different areas of Indore city in summer. Winter and Rain

Name of the plant		Unaffected	Roadside	Industrial	Textile mill
Anadirachta indica	W	11.75 ± 0.02	18.00 ± 0.05	14.20 ± 0.72	10.40 ± 0.65
	S	13.16 ± 4.31	22.58 ± 1.37	19.54 ± 4.17	12.90 ± 0.60
	R	14.40 ± 1.05	25.80 ± 0.34	24.00 ± 0.00	16.96 ± 0.50
Bauhinia variegate	W	22.03 ± 0.05	16.33 ± 1.25	25.35 ± 1.01	17.67 ± 0.76
	S	28.16 ± 2.17	22.66 ± 1.32	32.16 ± 0.85	21.06 ± 0.10
	R	32.30 ± 0.60	26.00 ± 1.80	34.50 ± 0.50	23.06 ± 3.26
Cassia fistula	W	25.58 ± 0.02	42.25 ± 0.43	35.36 ± 0.70	26.52 ± 4.31
	S	45.17 ±11.25	60.16 ± 11.36	38.60 ± 2.11	43.20 ± 1.37
	R	52.53 ± 1.62	62.30 ± 1.04	42.90 ± 0.79	46.00 ± 1.20
Cassia siamed	W	26.58 ± 5.44	14.58 ± 2.12	30.08 ± 0.28	25.33 ± 7.50
	S	28.08 ± 0.14	42.25 ± 0.43	34.00 ± 1.00	23.91 ± 1.84
	R	30.50 ± 1.10	44.50 ± 0.50	37.17 ± 0.90	29.90 ± 1.02
Clerodendrum inerme	W	10.03 ± 0.90	15.86 ± 0.70	10.56 ± 0.35	14.04 ± 2.93
	S	16.00 ± 3.60	19.63 ± 14.78	12.13 ± 0.50	23.75 ± 6.12
	R	20.30 ± 0.45	23.54 ± 1.39	15.90 ± 0.65	30.10 ± 1.60
Dalbergia sissoo	W	43.30 ± 1.15	25.20 ± 0.00	12.20 ± 0.20	17.67 ± 0.83
	S	28.43 ± 1.50	18.75 ± 1.50	10.40 ± 0.85	14.08 ± 2.87
	R	30.60 ± 0.95	21.50 ± 0.50	12.67 ± 0.76	18.90 ± 0.84
Euclayptus (Hybrid)	W	28.42 ± 1.76	24.33 ± 8.50	28.09 ± 0.15	24.26 ± 1.67
	S	39.00 ± 0.43	34.33 ± 5.63	29.80 ± 0.72	37.83 ± 1.01
	R	43.30 ± 1.15	40.30 ± 10.15	31.86 ± 0.80	40.10 ± 9.24
Syzygium cumini	W	22.00 ± 0.05	17.20 ± 0.20	24.64 ± 0.05	18.17 ± 0.02
	S	37.91 ± 5.54	25.83 ± 0.28	38.60 ± 0.80	35.33 ± 1.04
	R	41.10 ± 1.04	30.08 ± 2.52	42.00 ± 0.76	40.80 ± 1.15
Ficus religiosa	W	26.75 ± 3.13	18.50 ± 1.14	22.50 ± 1.50	24.26 ± 1.57
	S	40.50 ± 10.14	35.83 ± 1.04	29.33 ± 0.80	29.41 ± 1.04
	R	44.10 ± 1.64	39.90 ± 2.52	30.80 ± 0.76	31.10 ± 1.55
Mangifera indica	W	47.16 ± 5.39	40.23 ± 2.35	24.00 ± 3.19	53.16 ± 2.02
	S	28.08 ± 2.27	51.83 ± 2.02	33.26 ± 1.13	28.91 ± 0.01
	R	32.70 ± 1.10	61.44 ± 6.42	35.80 ± 0.91	29.60 ± 1.05

each plant species. Three sub samples were taken for estimation work. Protein estimation was done following the method or Lowry et. al. (1951)

Observation and Result

Protein contents of plants growing in different polluted areas are presented in Table No. 01, Result indicate that the protein contents showed a mixed response over control/Reference. In *D. sissoo*, highest reduction in all the areas and seasons was recorded, as it was 59.35% in Textile mill area for winter season. *Eucalyptus* hybrid, *Ficus religiosa* and *Syzygium cumini* also showed similar reducing trends in polluted areas.

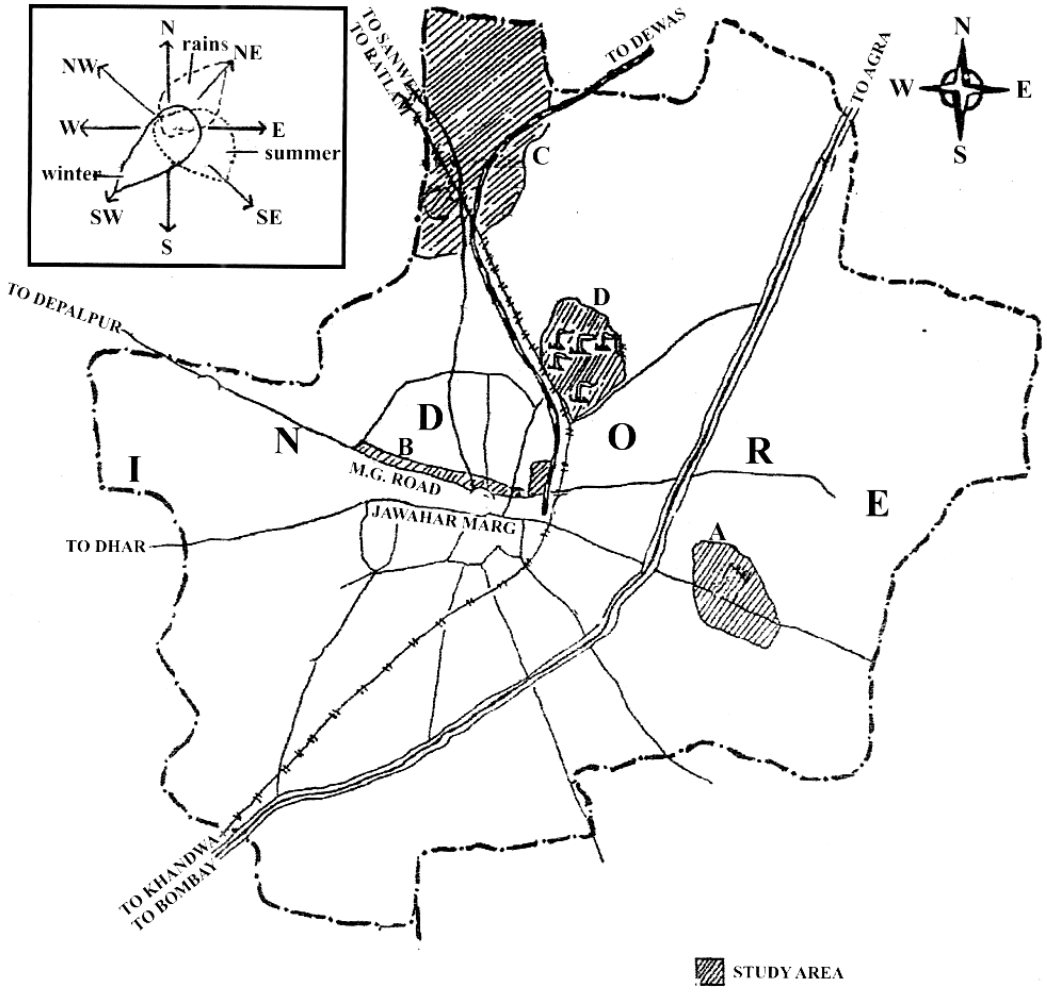

Figure 01 : MAP OF INDORE CITY SHOWING STUDY AREA AND SEASONAL WIND DISPERSAL
A - Unaffected | B - Roadside | C - Industrial | D - Textile Mill

An area wise variation has been clearly observed in protein contents in response to pollutants, as *B. variegata* and *S. cumini* in Textile mill area and road sides indicated reduction. On the contrary *A. indica* supported an increase in road side and industrial area. *C. inerme* in textile mill area and road sides showed an increase. Remaining plants behaved in a mixed way without showing any specific response.

Discussion

Protein metabolism under pollution stress has been a field of interest as it is one of the most important biological process. Decreased protein content in fumigated plants has been reported by Craker 1972; Constanitinidou and kozlowski 1979; Nandi et. at. 1980 and sardi 1981 Reduction in foliar protein content of *D. sissoo, F. religiosa* and *S. cumini* can be due to high SO_2

concentration in Textile mill area. Yunus et. al. (1985) reported a corresponding decrease in protein content with increasing SO_2 concentration in case of *Calendula* and *Dahlia*. Sisodia and Bedi (1986) observed the same trend in wheat plants growing in SO_2 prevailing areas. Chauhan et.al. (2012) reported reduction in protein content in leaves of *I. fistulosa, D. sissoo, A. indica, C. gigantea, A. arabica, S. indica* and *Eucalyptus* due to industrial air pollution. Constantinidiou and Kozlowski (1979) Suggested that reduction in protein content might be the result of decreased photosynthesis, SO_2 may also led to inhibition of protein synthesis or enhanced protein degradation (Rabe and Kreb 1980). Prieb et. al. (1978) have showed an increase in the levels of most or the amino acids and amines after fumigation. On the contrary amino acids like glutamate and aspartate get reduced in fumigated plants (Godzink and Linskens 1974, Piere and Queiroz, 1978). Malhotra and Sarkar (1979) opined that reduction in protein in pine needles after SO_2 exposure is a result of its breakdown into free amino acids. However, still it is not clear that the reduction in contents is a result of its breakdown or inhibition in synthesis. An increase in protein content in *C. inerme.*

C. siamea, B. variegate and others in industrial and roadside areas has been observed, which appears to be a result of combined action of SO_2 and NO_2 Howell and Rose (1980) found higher protein content in soybean exposed to ambient O_3. Possibility of O_3 induced changes can also be not denyed in road side area. It is also reported that low level of SO_2 (0.06 ppm) increased protein contents in soybean and peas (Sardi 1981). So is can be concluded that air pollutants alters protein metabolism of different plants in different ways.

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