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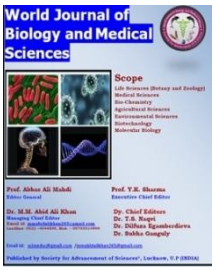

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RESEARCH PAPER

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A Study on Impact of Effluents of Paper Mill on Plants with Special Reference to Chlorophyll Content

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ABSTRACT

Pollution is a product of the activity of man. The pollutants contaminate air, water and soil. Field studies reveal that pollutants, generated at urban industrial locations, may disperse 50-100 km distance or more from the point of origin. Extensive field survey laboratory investigation has been carried out to study the effect of pollutants in and around industrial complexes of Nagaon Paper Mill (NPM) at Nagaon District of Assam. It gave an idea about the possible affect of the effluent released from the mill on the growth of the nearby plants. The left samples which were collected are subjected to chlorophyll estimation, done in the Lab of Biotech Hub, Dhing College, Nagaon, Assam. The amounts of chlorophyll a, b and carotenoids in terms of mg/g fresh leaves were calculated. The highest reduction of chlorophyll content is observed in tree is Ficus infectoria Roxb (1.63) and lowest in Grewia asiatica (4.22). In case of herb species it is highest in Ipomoea bataus (1.710 and lowest in Phyllanthus niruri (4.48).

Key words: Industrial effluents, Chlorophyll, Carotenoids, Ficus infectoria Roxb, Ipomoea bataus, Phyllanthus niruri and Grewia asiatica.

INTRODUCTION

As man started manufacturing chemicals and metal, generating electrical power, developing faster means of transportation and crowding in over populated cities, the problem of air pollution become inevitable. The environment began to lose its earlier purity due to the concentration of smoke and other pollutants. The pollution emitted from a factory i.e. a point source of pollution or from a city complex is an area source of pollution, get dispersed distributed and diluted in the air mass of the adjoining areas. Field studies reveal that pollutants generated at urban industrial locations may disperse 50-100 km distance or more from the point of origin, and they trespassing all geographical boundary, be it local, national and international. So air pollution do not remain confined in the vicinity of industrial establishment or emission source, but depending on topography and meteorology of the area, these may spread into far off places of the natural landscape affecting growth development and productivity of plants and animals present there **(Rao 1980)**.The pollutants contaminate air, water and soil; corrode materials, dirty building and clothing, harms plants and wild life and affect human health. To determine the extent of environmental change takes a careful study of ecological system. The living system are interrelated and well adjusted to their environment comprising biotic components of plants, animals and microbes and a biotic ones of soil, water, air and physical factor of light, wind and temperature. The correlation between growth transitions of green plants has helped decipher pollution zone **(Rao and Le Blanc 1967)**. These zone extended in the direction of prevailing wind assuming and elliptic shape, the axis of the being oriented from south east to north direction with the pollution source at the south west end.. In such instances the north east extension of the ellipse penetrates deep into the natural and rural habit **(Rao 1980)**.

In India the problem of pollution has reached alarming proportion due to the concentration of industries on some selected pockets. In the state of Assam, several such pockets are located. The present report is based on the investigation carried out at Nagaon (NPM Complex) to study the damaging effect of air pollutants on plants with special reference to pigment contents.

MATERIAL AND METHOD

Field studies around Nagaon paper Mill (NPM) were conducted to get an idea about the possible affect of the effluents released from the mill on the growth of the nearby plants. From the visual assessment the detrimental effects of the effluents on the plants was substantive up to a distance of about 1km from the sources. The morphological conditions of plants were observed and are recorded. The left samples which were collected are subjected to chlorophyll estimation at the laboratory of IBT Hub, Dhing College. The chlorophyll of fresh leaves was analyzed quantity following the method of ***Duzbury & Yentsh (1950).*** Chlorophyll: Chl a, Chl b and carotenoids contents were determined by extracting from fresh leaves (10gms) in 50 ml of 80% acetone kept in dark for 24 hours. Optical densities were recorded at 480, 510 and 663 mm wavelength using Spectrometer. The amounts of chlorophyll a, b and carotenoids in terms of mg/g fresh leaves were calculated by using the formula given by ***Duzbury and Yentsh (1956).***The results of analyses were tabulated in ***Table 1, 2 & 3*** and ***Fig 1 & 2.***

Table 1. Photosynthetic pigments (mg dry weight) of important tree species growing within 1km of the source in the Nagaon area (NPM Complex).

Name of the trees	Injury symptoms	Chlorophyll a		Chlorophyll b		Total (A+B)		Carotenoids	
		UPS	PS	UPS	PS	UPS	PS	UPS	PS
Acacia arabica wild	IC	10.64	2.01	1.98	1.98	4.62	3.99	2.90	1.47
Eucalyptus spp.	TB	1.71	1.30	1.24	1.24	2.95	2.54	2.10	1.51
Magnifera indica	MN&IN	1.79	1.40	1.30	1.30	3.09	2.70	1.67	1.68
Dalbergo sisoo Roxb	MN	2.56	1.90	2.10	2.10	4.66	4.00	2.83	2.03
Ficus glomerata Hort. Ex. Mig	TB	2.18	1.81	1.95	4.13	3.76	2.07	1.94	1.95
Alstonia schblaris R. Br	IC	2.41	2.23	1.80	4.21	4.03	2.45	1.80	1.80
Ficus infectoria Roxb	MN&TB	1.15	0.68	1.20	0.95	2.35	1.63	1.41	0.61
Azadirachta indica A. Juss	IN	2.92	1.64	2.66	2.66	5.58	4.30	2.66	1.70
Butea monosperma Lam. Taub	TB	1.79	0.77	1.50	1.50	3.29	2.27	1.45	0.88
Prosopis J indicus Dalz	IC	2.15	1.72	1.76	1.76	3.91	3.48	2.07	1.62
Tactona grandis L	MN	2.41	2.00	2.05	2.05	4.46	4.05	3.01	2.70
Grewia elastic Royle	IC	3.32	2.06	2.68	2.16	6.00	4.22	2.99	1.54
Syzygium Armaticum L (Merr)	TB	2.23	2.10	2.20	2.20	4.43	4.30	1.80	1.31
Polyathia Longifolia B&H	TB	2.20	2.00	2.12	1.96	4.32	3.96	2.00	1.50
Annona souamosa Linn	IC	2.78	1.75	2.16	2.16	4.94	3.91	2.72	1.69

UPS-unpolluted site, **PS**- polluted site, **IN**- intervenial necrosis, **MN**- marginal necrosis, **TB**-tipburn, **IC**- intervenial chlorosis.

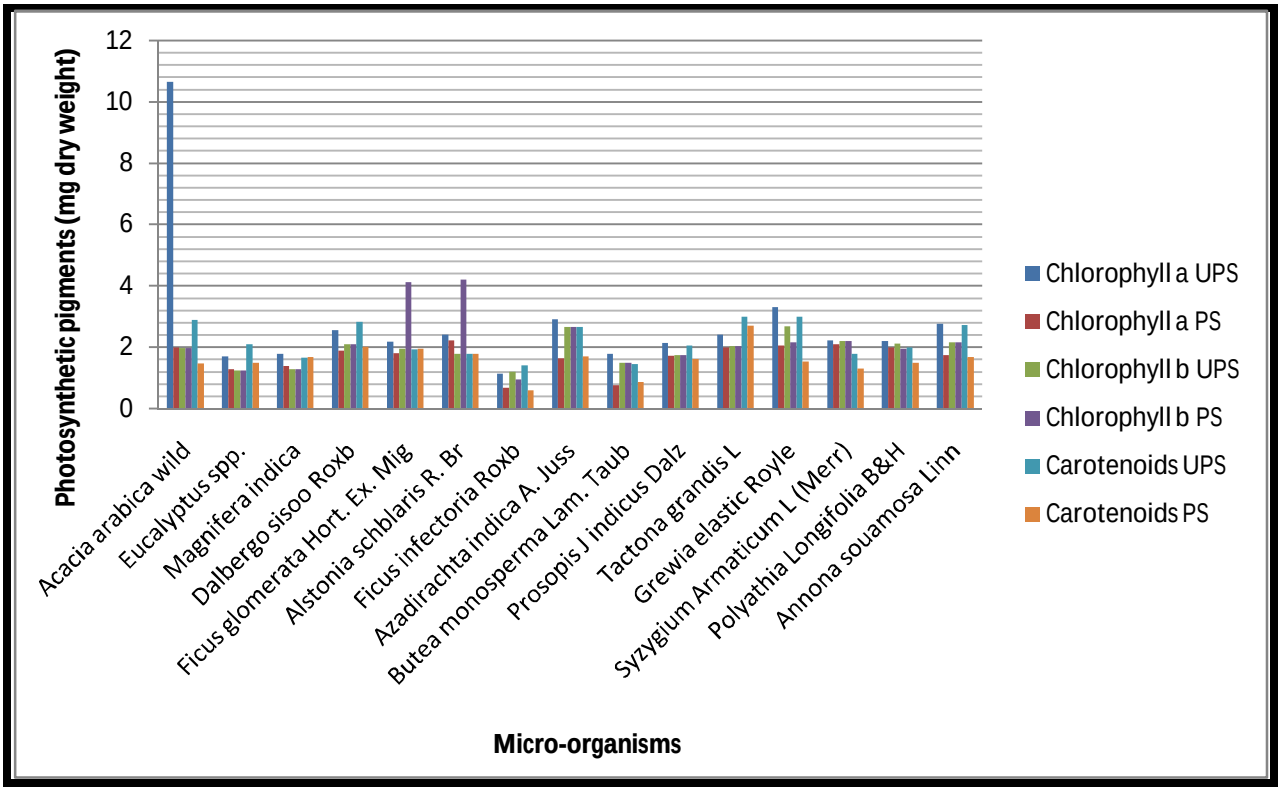

Fig 1. Photosynthetic pigments (mg dry weight) of important tree species.

Table 2. Photosynthetic pigments (mg dry weight) of important herb species growing within 1km of the source in the Nagaon area (NPM Complex).

Name of the herbs	Injury symptoms	Chlorophyll a		Chlorophyll b		Total (A+B)		Carotenoids	
		UPS	PS	UPS	PS	UPS	PS	UPS	PS
Catharanthus roseus G.Don	IC	2.15	1.81	2.05	1.30	4.20	3.11	3.12	2.71
Croton tiglium L	IN	1.63	1.52	1.53	1.22	3.16	2.74	2.74	1.83
Agremone Mexicana L	IC&MN	1.70	1.40	1.46	1.17	3.16	2.57	2.91	2.70
Chrozophora Plicata. Hook	TB	2.40	2.26	2.23	2.03	4.63	4.29	3.18	3.12
Euphobia hirta Linn	IC	2.02	2.01	2.00	1.82	4.02	3.83	3.54	3.23
Musa sapientum Linn	MN	2.35	2.16	2.31	2.01	4.66	4.17	2.82	2.40
Ipomoea batatus. Lamk	TB	1.10	0.97	1.09	0.74	2.19	1.71	1.67	1.25
Cynodon daetylon Pers	IC	2.80	1.70	2.60	1.46	5.40	3.16	3.63	2.89
Leucus aspera. Spreng	IC	1.61	1.27	1.37	1.31	2.98	2.58	2.40	2.26
Phyllanthus niruri. Linn	MN	2.76	2.40	2.66	2.08	5.42	4.48	3.55	2.96

UPS-unpolluted site, **PS**- polluted site, **IN**- intervenial necrosis, **MN**- marginal necrosis, **TB**-tipburn, **IC**- intervenial chlorosis

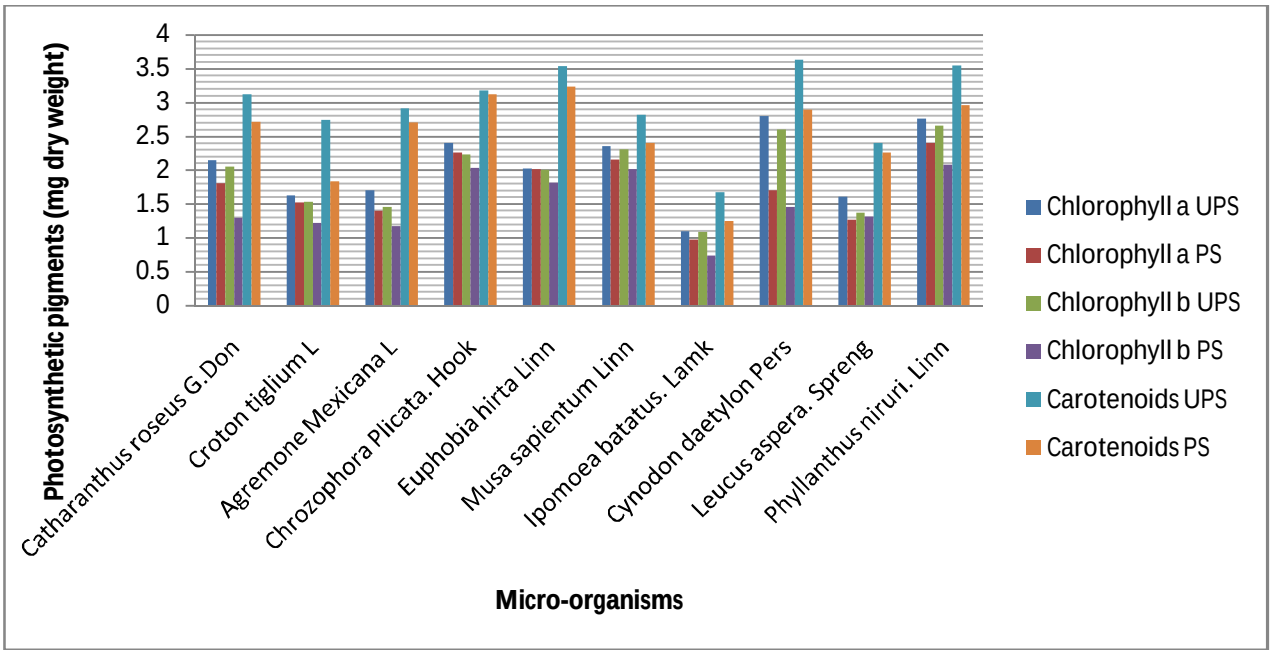

Fig 2. Photosynthetic pigments (mg dry weight) of important herb species.

Table 3. Growth response of a few important tree species against pollutant in 1km range of Nagaon.

Name of the tree	Stem perimeter at breast height (m)		Dry weight (gm/leaf)		Chlorophyll content mg dry weight		Leaf injury index (1&2)
	UPS	PS	UPS	PS	UPS	PS	
Magnifera indica L	1.07	0.69	0.55	0.37	4.75	2.05	51.23
Tectona grandias L	0.94	0.60	2.61	2.03	3.61	2.34	54.28
Cassia fistula L	1.53	0.34	0.49	0.37	3.56	2.08	57.75
Adina cordifolia Benth & Hook	0.45	0.38	0.56	0.40	4.45	1.56	No injury
Madhuca indica J.F. Gmel	0.48	0.52	0.78	0.66	2.98	1.84	34.76
Diospyros melanoxylon Blume	0.53	0.58	0.81	0.52	2.43	2.10	No injury
Fiscus infectoria Roxb	0.68	0.72	0.46	0.30	3.16	2.21	40.01
Grewia asiatical	0.51	0.48	0.65	0.55	3.26	2.05	20.25

Average of 50 leaves, **UPS**-unpolluted site, **PS**- polluted site

RESULT AND DISCUSSION

Extensive field survey laboratory investigation has been carried out to study the effect of pollutants in and around industrial complexes of Nagaon Paper Mill (NPM) at Nagaon District of Assam.

Sulphur dioxide and particulates are the main pollutants of these areas causing extensive damage to natural vegetation through Cs_2, H_2S and Cl users also present in these areas. Tip burn, interveinal necrosis and yellowing of leaves are the common foliar injury symptoms. Out of fifteen tree sps and ten herb sps. studied, nine showed significant reduction in stem perimeter, dry weight and chlorophyll content. The reduction is chlorophyll content occurred in near to the site of pollution and lowest away from the source from pollutants. Since leaves constitute the most important part for trapping solar radiation, the leaf area becomes an important parameter for determining photosynthetic ability of plant community. The ecological significance of area is due to chlorophyll, which forms the basis of dry matter production in plants. Amount of chlorophyll in a plant gives the measure of its productive potential. Under a given environmental condition, high accumulation of organic matter results from an adequate amount of plant pigment **(Whittaker and Garfine, 1962)**.The highest reduction of chlorophyll content is observed in tree is **Ficus infectoria Roxb (1.63)** and lowest in **Grewia elastic Royle (4.22**) from Table 1. In case of herb species it is highest in **Ipomoea bataus (1.710**) and lowest in **Phyllanthus niruri (4.48)** from Table 2.

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