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Pigment Profile and Chllorophyll Degradation of *Pyxine cocoes lichen*: A Comparative Study of the Different Degree of Disturbance in Cachar District, Assam

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Abstract

Present investigation has been promulgated to study pigment profile and chlorophyll degradation of lichen communities within areas of different degree of disturbances in Cachar district. Chlorophyll a, chlorophyll b, total chlorophyll and carotenoid were measured to estimate the possible damage caused by the metallic pollutants in the lichen, Pyxine cocoes collected from 25 sites of the study area. Total chlorophyll is highest in Ecoforest (1.43 mg/l whereas Carotenoid is lowest in Ecoforest (0.17 mg/l).Chlorophyll degradation was measured as a parameter of air pollution experiment.

Key words: Lichen, *Pyxine cocoes*, physiological interaction.

Introduction

Lichens are often and effectively used as monitors of pollution. Lichens have certain characteristics that make them ideal biomonitoring organisms (Upreti *et.al.* 2008). During the last few decades increased human interference, urbanization and heavy vehicular activity in Cachar district have resulted the changes air quality. Lichens are among the most valuable biomonitors of atmospheric pollution (Upreti *et. al.* 2006).They have certain characteristics which meet several requirements of the ideal biological monitor. The first observation on sensitivity of lichens to air pollution dates back to 19th Century (Nylander, 1886). Since then large number of investigations in various countries have been carried out (Carreras, *et. al.* 1998, Bargagli *et. al*. 2002). Das *et.al.* (1986) studied lichens of Kolkata city streets in relation to traffic load. The use of lichens in biomonitoring of particulate pollutants has gained increasing acceptance in recent years. Lichen biomonitoring is especially useful in urban areas, where high density of different emitting sources make monitoring of air pollution with conventional chemico-physical gauge an extremely difficult task due to variety of pollutants. A number of parameters are used to estimate the effect of air pollution on lichens (Ronen & Galun, 1984). Chlorophyll content and chlorophyll degradation are parameters commonly used to assess the impact of air pollution on lichens (Silberstein and Galun, 1988). The most obvious sign of pollution damage to lichens is bleaching of the thalli, caused by decomposition of chlorophyll. Metallic pollutants are known to disrupt the vital physiological processes (Upreti & Shukla, 2007). Chlorophyll in lichens is very sensitive to changes in environmental factors including air pollution (Boonpragob, 2002). The analysis of lichens for different mineral concentrations could provide a method for monitoring atmospheric deposition of elements in an area. The aim of this study is to investigate damage to chlorophyll in lichens in relation to different levels of air pollution at selected monitoring sites in the district.

Materials and methods

Silchar is the district headquarter of Cachar district.

It lies between 24°49' N latitude and 92°48'E longitude on the left bank of river Barak . The study area is covered by a distance of about 25 km. It is surrounded by Borail hills on the north, Manipur on the east, Bangladesh on the west and Mizo hills on the south. The study area has been divided into five major groups. Each group contains five different sites. The group has been differentiated on the basis of their traffic load, types of vehicles, etc. Group A is considered as the main town area, business centre, and heavy traffic load. Group B is considered as thickly populated and nearby town area; all types of

Fig.1. ***Pyxine cocoes (Sw.) Nyl.***

vehicle are running. Group C &D are the outskirts from town; Group C is thickly populated residential area in both sides of the main road whereas Group D is more or less open vegetation, rice field, less populated area. Last three sites of Group E are totally undisturbed and first two sites are less populated and University area is also less affected from pollution except those vehicles servicing within the campus. The study was carried out with a foliose lichen, *Pyxine cocoes* growing on trees of 25 different sites (Fig.1). Samples were collected from 20-150 cm height from the ground in the roadside of the study area. Sampling was performed during March-May, 2006 from polluted and relatively clean areas. In each sampling period 8-10 samples were collected in order to represent any natural variations of chlorophyll content. The specimens were dried and preserved in the laboratory and identified on the basis of morphology, anatomy and chemistry with the help of recent literature and Lichenology laboratory, NBRI, Lucknow. Lichen samples were carefully removed from the bark, using a snapper blade and were air dried and washed with acetone and then ground in mortar with Quartz sand in 80% acetone. The supernatant was obtained at 5000 rpm for 10 minutes and conserved in crushed ice. Absorbance (A) measures were taken at 663, 645, 435, 415, 480, 510 nm using spectrophotometer. The ratio of OD 435/OD 415 as parameter for chlorophyll degradation (Ronen &Galun ,1984).The chlorophyll content was calculated from absorbance values at 663 and 645 nm according to the equation of Arnon (1949). The total carotenoid content was calculated according to Parsons et. al. (1984) from absorbance values at 480 and 510 nm using Genesys 10 UV scanning spectrophotometer.

Results and discussion

The study was conducted on the occurrence of *Pyxine cocoes* growing luxuriantly on the tree bark. All the sites show good growth of lichens on the bark surface. Among the Physciaceae family *Pyxine* is the dominant contributor. *Pyxine cocoes* and *Pyxine petricola* were found from the study site. In the present study *Pyxine cocoes* was undertaken for the pigment analysis. Results of various pigments (chl.a. chl.b. total chl. and carotenoid) and chlorophyll degradation analysis are presented in Table 1. The table shows the value of quantified parameters corresponding to each one of the sampling points. From the observation it is clear that chlorophyll content is more in site-23 (Ecoforest-1,1.43mg/l) followed by site -24 (Ecoforest-2,1.27mg/l) and lowest in site-1 (Sadarghat-0.79mg/l) and Fakirtilla (Site-15,0.51mg/l). It is observed that the concentration of chl.a. and chl.b., is affected by the traffic load. Chlorophyll content may vary from one site to another depending on their habitat, climatic condition, pollution level, etc. Chlorophyll content decreases when the pollution decreases. It may vary depending on the air quality of that area. The

highest amount of carotenoid was noted in site-3 (Hospital road-0.46mg/l) and site-12 (veterinary 0.46mg/l). Higher carotenoid content was reported from disturbed area. It becomes higher in more polluted area, and it may also be less in polluted area depending upon the vegetation type, climatic condition, etc. Chlorophyll degradation measurements were intended as a parameter of air pollution experiment. From the result it was found that chlorophyll degradation is highest in site -11 (Medical road-2.12mg/l) followed by site-17 (Barambaba-2.02mg/l). Medical road has received lots of smoke, dust, dirt from heavy traffic, automobile workshops, etc. Since it is a medical college area that received 24 hours of heavy traffic and the garbages, either it may be medicinal or may be domestic were thrown in the roadside and the area becomes polluted after a period of time. Chlorophyll degradation is lowest in site23 and 25 (Ecoforest 1 and 3), both sites are

Table 1

Analysis of Chlorophyll concentration, Chlorophyll degradation and Caroteniod content (mg/l)

GROUP	Site No.	Site Name	Chl. a (mg/l)	Chl. b (mg/l)	Total Chl. (mg/l)	Chl.Degradation (mg/l)	Carotenoid (mg/l)
A	1	Sadarghat	0.36	0.44	0.79	1.29	0.37
	2	Premtala	0.41	0.43	0.84	1.72	0.33
	3	Hospital Road	0.51	0.52	1.01	1.58	0.46
	4	Rangirkhari	0.54	0.37	0.91	0.47	0.23
	5	Link Road	0.56	0.52	1.08	0.45	0.40
B	6	Kathal Road	0.45	0.39	0.84	0.76	0.19
	7	Meherpur	0.33	0.40	0.73	1.06	0.24
	8	Polytechnic	0.41	0.43	0.84	1.04	0.33
	9	Green Park	0.44	0.47	0.91	0.64	0.38
	10	Durga Palli	0.31	0.37	0.67	1.11	0.17
C	11	Medical Road	0.36	0.37	0.73	2.12	0.18
	12	Veterinary	0.33	0.47	0.80	0.94	0.46
	13	Kuarpar	0.57	0.67	1.24	1.12	0.27
	14	NIT	0.42	0.43	0.85	0.84	0.18
	15	Fakirtilla	0.16	0.35	0.54	0.72	0.23
D	16	Barik Nagar	0.49	0.40	0.89	1.49	0.24
	17	Barambaba	0.43	0.46	0.89	2.02	0.32
	18	Silcoorie	0.41	0.53	0.94	1.09	0.37
	19	Mitha Pani	0.41	0.46	0.87	1.72	0.24
	20	Forest Gate	0.43	0.41	0.84	0.95	0.28
E	21	Darga kona	0.24	0.41	0.65	0.91	0.28
	22	University Campus	0.47	0.50	0.95	0.77	0.33
	23	Ecoforest (1)	0.72	0.71	1.43	1.34	0.19
	24	Ecoforest (2)	0.68	0.59	1.27	0.48	0.35
	25	Ecoforest (3)	0.45	0.50	1.95	0.36	0.32

undisturbed habitat, which received clean air, no traffic and other smoke producing activities are also absent. Lichens can grow very well in this type of habitat. It means that if there is less chlorophyll degradation, the amount of chlorophyll content will be more. Similar studies were also found by Backor *et al*. 2002. In their study, the highest value for chl. a. concentration was found in control sites and the lowest chl. a. concentrations were recorded at the industrial area. The highest content of chl.b. was measured in the outskirts and lowest in the city center. However the lowest degree of chlorophyll degradation was observed at sites related to city periphery while the highest were observed at sites related to industry and city center. The amount of total chlorophyll, of chlorophyll a, and of chlorophyll b was inversely proportional to the SO_2 concentration (Le blanc and Robitaille 1976). It is a baseline records for carrying out future studies related with the ambient air in the area. It can be inferred that *Pyxine* is a good mitigator of industrial fallouts.

Conclusion

The study using a single epiphytic lichen species showed that a single species can be used to determine air pollution in Cachar district. The present pigment analysis will provide a baseline data for further impact assessment programme related on ambient air quality in the area.

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