

Preliminary Study of Allergenic Algae of Air at Human Breathing Level from Nagpur

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ABSTRACT

Daily sampling of air at human breathing level was done for 11 months to study aero-algal forms and their possible impact on human health. For collecting daily air samples, a modified sampler (smaller version of Aeroscope) specially designed for collecting samples near ground level was developed. This modified sampler was mounted on a vespa scooter front, to collect average daily sample of Nagpur city. Such investigation of algae present in the air, at human breathing level has been attempted for the first time.

Cyanophyta was found to be dominant group, followed by Bacillariophyta, Chlorophyta and Euglenophyta. Total 16 algal genera were identified, out of which algal forms such as *Phormidium*, *Lyngbya*, *Anabaena*, *Scytonema*, *Microcoleus* and *Fragilaria* known to be allergenic to human beings were also reported.

Key words: Aero-algae, Human breathing, Aeroscope, Allergenic.

INTRODUCTION

We all know that, the air surrounding us is full of bio-pollutants, such as fungal spores, pollen grains, mites etc. including algae as one of its hazardous component.

Study of algae from atmosphere dates back to 1844 when a German naturalist (Ehrenberg, 1844)¹ identified 13 genera of algae from a sample of sea dust. Woodcock (1948)² related algae to respiratory diseases, when he noted the presence of 'sea water nudci' in oceanic air and suggested the creation of aerosols by the bursting bubbles from breaking waves. Heise (1949, 1951)³⁻⁴ co-related algae with symptoms of hay fever and asthma and showed cross reactivity between *Oscillatoria* and *Microcystis*. Mc. Elhenney *et al.*, (1962)⁵ reported allergenicity of green algae to children having inhalant sensitivity. Salisbury (1966)⁶ using glass plates and wind funnel trap collected disease producing algae from air. Bernstein and Safferman

(1966, 1970)⁷⁻⁸ also examined allergenicity of algae with respect to skin reactivity of *Chlorella* and *Chlorococcum* in 69% of their patients. Lunceford (1968)⁹ also studied and substantiated allergenicity of algae. Holland (1973)¹⁰ reported over 40 genera of algae collected from house dust samples in viable condition, many of such genera being allergenic. Schilting (1985)¹¹ pointed out air born toxic algae as a positive health hazard.

Mittal *et al.*, (1973, 1979)¹²⁻¹³ reported *Lyngbya major* as a positive allergenic form. Goyal (1976)¹⁴ commented on the allergenicity of algae. Nair *et al.*, (1983)¹⁵ and Sundersankumar *et al.*, (1984)¹⁶ at Bareilly reported air born *Aphanocapsa*, *Calothrix* and *Lyngbya* as a possible association with bronchial allergy and water pollution. Santra (1987)¹⁷ studied air borne algae of Calcutta and reported 17 algal forms and related his work with algal allergy. Tilak (1992)¹⁸ while reviewing work on aerophycology reported several chlorophycan and cyanophycan allergenic forms. Bajpai *et al.*,

(2009)¹⁹ have reported hepatophenomegaly and phytotoxicity of planktonic cyanobacterium *Nostoc*. Marathe and Reddy (1980)²⁰ has reported 21 algal forms from Nagpur atmosphere.

A review of literature indicates that although there are several reports of air born algae from different altitudes, monitoring of such potential health hazard has not been attempted near ground level- (Human Breathing Level).

MATERIAL AND METHODS

For this work a new air sampler (modified and smaller version of Aeroscope, Lakhanpal and Nair, 1958)²¹ was developed. This consisted of a round vertical M.S shaft (12.5mm diameter and 20 cm length) with threading at its base. Sliding over this shaft was placed a hollow M.S pipe (37.5mm diameter and 15 cm length) moving around the central shaft, on two ball bearings (fitted at the top and bottom of the pipe). A small tail shaped wind wane (12 cm diameter and longest extremity 16 cm) made of 16 gauge M.S sheet, was welded along the length of this pipe. A flat M.S flange (5cm O.D) was welded at the top of the pipe. A horizontal, rectangular (11cmX6cmX6cm) slide carriage, made of aluminium sheet, was mounted on this flat flange. One small slide carriage strip (2.5cmX10cm) was mounted at an angle of 45o near the exposure end (end away from wind wane) of the slide carriage. Entire sampler was spray painted (Fig-1).

Such a sampler was mounted on the front mudguard of a vespa scooter, with nuts around base threading of the central shaft. Thus due to ball bearing and wind wane, the sample slide always faced wind current, whenever the scooter was in motion. This sampler was mounted on the scooter of Shri. S.V.Khadke, a sales executive, who was everyday moving around the city (average 30-40km per day) for his work.

Slides were exposed at an average height of about 83 cm (including the height of aeroscope) above the country ground level. Slides for everyday exposure were prepared by spreading a thin layer of petroleum jelly (adhesive). Such slides were fixed on the slide carrying strip with the help of rubber bands. Each slide, after exposing for one complete

day, was mounted in glycerine jelly, under a rectangular (25X40mm) coverslips.

This slides, were scanned under microscope, for the presence of algal forms. Algal genera were identified visually on the basis of their morphological characters, by comparing them with reference slides of local algal flora and also by referring to available literature (Cyanophyta, Desikacharya, (1959)²², Fritsch, 1935, 1945)²³⁻²⁴.

RESULTS AND DISCUSSION

During 11 months sampling 334 slides were exposed and 273 algal forms were recorded.

Maximum numbers of algal forms were recorded during March-April and November-January period. Minimum numbers were observed during August- September, which may be partly attributed to high winds and rains.

As usual Cyanophyta was the dominant group represented by 255 algal forms. Bacillariophyta were represented by 14 forms followed by Chlorophyta (2) and Euglenophyta (2).

Out of various genera identified *Phormidium* (22) was the most frequent one and was recorded during six months. This was followed by *Lyngbya* (8) for four months, *Gloeocapsa* (5) for four months, *Scytonema* (4) and *Merismopedia* (4) each for three months and *Microcoelus* (2) and *Chroococcus* (2) each for two months. *Tolypothrix*, *Calothrix*, *Anabaena*, *Plectonema*, *Ulothrix*, *Trentifolia*, *Euglena*, *Pinnularia* and *Fragilaria* were recorded one each (Table-1).

Out of various genera recorded 6 species of *Phormidium*, 3 of *Lyngbya*, 3 of *Gloeocapsa*, 2 of *Chroococcus* and one of *Merismopedia*, *Scytonema* and *Plectonema* were identified to species level (Table-2).

In this investigation, a considerable number of algal forms, many of them, known to be allergenic to human beings were recorded from the air near ground level at Nagpur.

Maximum numbers of algal forms were recorded during March-April and November-

Table 1: Ground level aero-algal calendar of Nagpur

S.No	Particulars	Nov-94	Dec-94	Jan-95	Feb-95	Mar-95	Apr-95	May-95	Jun-95	Jul-95	Aug-95	Sep-95	Total
A	CYANOPHYTA	30	22	31	26	43	30	25	16	19	9	4	255
1	Coccoid forms	13	1	4	5	16	2	10	7	13	6	-	77
2	Filamentous forms	17	21	27	21	27	28	15	9	6	3	4	178
3	<i>Lyngbya</i>	1	2	-	-	-	-	4	-	1	-	-	8
4	<i>Gloeocapsa</i>	1	-	-	-	1	-	-	2	1	-	-	5
5	<i>Microcoleus</i>	1	-	-	-	-	-	-	-	-	-	1	2
6	<i>Phormidium</i>	-	1	1	5	9	5	1	-	-	-	-	22
7	<i>Scytonema</i>	-	1	1	2	-	-	-	-	-	-	-	4
8	<i>Tolypothrix</i>	-	-	1	-	-	-	-	-	-	-	-	1
9	<i>Calothrix</i>	-	-	-	1	-	-	-	-	-	-	-	1
10	<i>Anabaena</i>	-	-	-	1	-	-	-	-	-	-	-	1
11	<i>Merismopedia</i>	-	-	-	1	-	-	1	-	2	-	-	4
12	<i>Chroococcus</i>	-	-	-	-	-	-	-	1	1	-	-	2
13	<i>Plectonema</i>	-	-	-	-	-	-	-	1	-	-	-	1
B	CHLOROPHYTA	1	-	-	-	-	-	-	1	-	-	-	2
1	<i>Ulothrix</i>	1	-	-	-	-	-	-	-	-	-	-	1
2	<i>Trentipholia</i>	-	-	-	-	-	-	-	1	-	-	-	1
C	EUGLENOPHYTA	-	-	-	-	1	1	-	-	-	-	-	2
1	<i>Euglena</i>	-	-	-	-	1	1	-	-	-	-	-	2
D	BACILLARIOPHYTA	2	-	1	-	-	-	-	-	6	2	3	14
1	<i>Pinnularia</i>	1	-	-	-	-	-	-	-	-	-	-	1
2	<i>Fragilaria</i>	-	-	-	-	-	-	-	-	1	-	-	1
E	positive record days	23	15	17	17	21	21	16	12	16	8	8	174

January period (Table-1). Such higher concentrations of air borne algae during post monsoon and dry summer month have also been reported earlier (Devi and Sing, (2005)²⁵ and Santra (1987)¹⁷).

Some of the algal forms recorded here have also been reported earlier. Algal taxa such as *Phormidium*, *Lyngbya* and *Plectonema* have been reported from air of Nagpur at high altitudes

Table 2: Ground level aero-algal flora of Nagpur

S. No.	Genus	Species	Total
A	CYANOPHYTA	-	255
1	<i>Lyngbya</i>	-	06
1.1	—,,—	<i>gracilis</i>	01
1.2	—,,—	<i>aerugineo</i>	01
1.3	—,,—	<i>martensiana</i>	01
2	<i>Gloeocapsa</i>	-	05
2.1	—,,—	<i>rupestris</i>	01
2.2	—,,—	<i>pleurocapsoides</i>	02
2.3	—,,—	<i>stegophila</i>	01
3	<i>Microcoleus</i>	-	02
4	<i>Merismopedia</i>	-	04
4.1	—,,—	<i>punctata</i>	04
5	<i>Phormidium</i>	-	22
5.1	—,,—	<i>stagnina</i>	03
5.2	—,,—	<i>anomala</i>	03
5.3	—,,—	<i>subincrustatum</i>	02
5.4	—,,—	<i>retzii</i>	02
5.5	—,,—	<i>angustissimum</i>	01
5.6	—,,—	<i>truncicola</i>	01
6	<i>Scytonema</i>	-	04
6.1	—,,—	<i>schmidtii</i>	01
7	<i>Calothrix</i>	-	01
8	<i>Anabaena</i>	-	01
9	<i>Chroococcus</i>	-	02
9.1	—,,—	<i>minor</i>	01
9.2	—,,—	<i>minutes</i>	01
10	<i>Plectonema</i>	-	01
10.1	—,,—	<i>radiosum</i>	01
11	<i>Tolypothrix</i>	-	01
B	CHLOROPHYTA	-	02
1	<i>Trentipholia</i>	-	01
C	BACILLARIOPHYTA	-	14
1	<i>Pinnularia</i>	-	01
2	<i>Fragilaria</i>	-	01
D	EUGLENOPHYTA	-	02
1	<i>Euglena</i>	-	02
1.1	—,,—	<i>acus</i>	02

(Marathe and Reddy, 1980)²⁰. *Calothrix*, *Chroococcus* and *Microcoleus* have been reported from the air of Cairo District of Egypt (Ahmed D.E.L. Gamal, 2008)²⁶. *Merismopedia* and *Tolypothrix* have been reported from the air of Hawaii (Brown *et al.*,

1964)²⁷. *Fragilaria* and *Anabaena* have been reported from house dust (Bernstein and Safferman, 1970)⁸. *Gloeocapsa* have been reported from building walls of Allahabad (Chadha and Pande, 1982)²⁸ and *Scytonema* has been reported

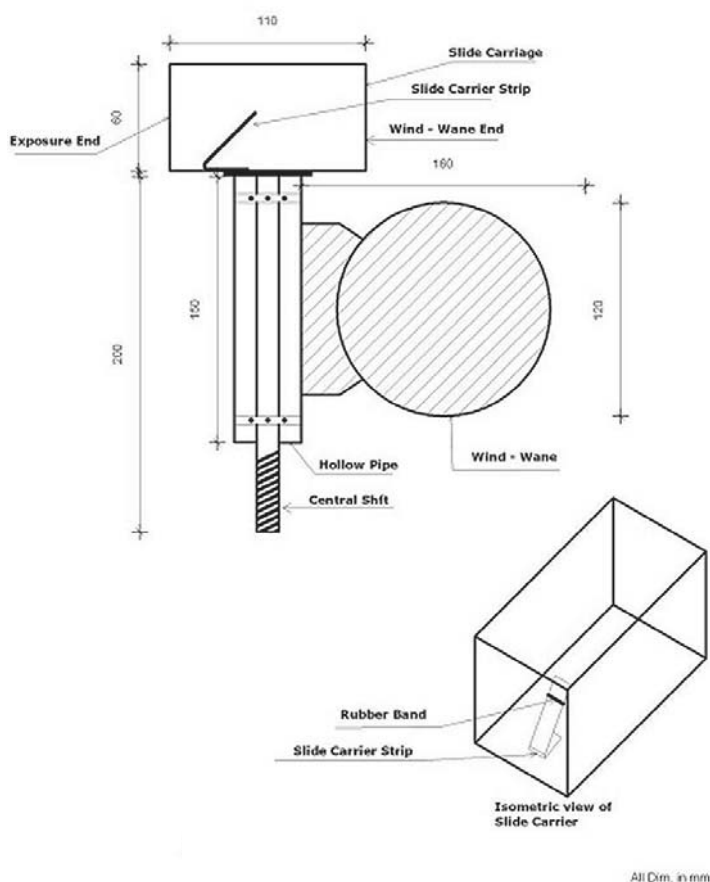


Fig. 1: Aeroscope

from the atmosphere of Calcutta Metropolis, (Santra, 1987)¹⁷.

Forms such as *Phormidium*, *Lyngbya*, *Anabaena* and *Scytonema* (Mittal *et al.*, 1979)¹³, *Microcoleus* and *Fragilaria* (Tilak, 1992)¹⁸ and *Anabaena* (Goyal, 1976)¹⁴ recorded here have been reported to be allergenic to human beings.

Presence of such allergenic forms at human breathing level at Nagpur points to the presence of a serious health hazard and there is

need for more such details studies. Moreover, this being a preliminary study. Simultaneous culturing of algae was not attempted here. Such additional simultaneous culturing can be expected to produce more promising results.

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