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## RESEARCH ARTICLE

# AIR DISPERSION OF VIABLE ALGAE IN THE EXTRAMURAL ENVIRONMENT OF PUNE.

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### Abstract

Air dispersion of viable algae in the extramural environment of Pune have been studied for six months, fortnightly from October 2011 to March 2012 by impaction culture method using BBM medium. As per the existing record of 24 algal aeroallergens, we found 15 genera and 21 species at Pune. These belong to Cyanophyceae 11 Genera & 21 species, Chlorophyceae 2 genera and Bacillariophyceae 2 genera i.e. Anabaena (6 Sp.), Phormidium (4 Sp.) and Calothrix (3 Sp.) etc. recorded causing allergy in sensitive victims. Out of totally recorded 228 airborne algal genera we found 40 algal genera and 29 species of which 3 have been found to be new record for aerobiology in India. These are Camptylonema Sp., Dichothrix Sp. and Psedoanabaena Sp.

During this study 528 colony unit have been selected randomly, which revealed maximum percentage contribution of Chroococcus Sp. (14.9%) as dominant genus followed by Chlorella and Chlamydomonas (9.96%) each to the total aerophycoflora. Hence, it has been proved that these three unicellular algal forms have been found to be dominant as compared to colonial and filamentous forms of algae. Site wise dispersion and distribution of aeroalgae revealed that maximum 12 genera have been recorded at site no.5 followed by site no.6 (11 genera) and minimum at site no. 3 (3 genera).

Site wise frequency studies revealed highest count of Anabaena (188 out of 528 regularly at all the six sites) followed by Chlorella (178 out of 528) and Phormidium (170 out of 528). Only Anabaena was found at all the six sites constantly, while Gloeocapsa (at Site no.6), Scytonema (Site no. 5) and Aulsoria (Site no.5) each at single site only and absent at remaining five sites.

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### Introduction:

Marvelous contribution of various scientists consequently resulted in the development of aerophycology as a new branch of science. Prominent among them are Parshwanath (1979), Singh (1981), Tilak (1983), Santra (1987), Sabia Anis (1989), Sharma (1990), Ramchandra Rao (1996), Jadhav (2006), Quazi (2010), Tarar (2010) etc. Hence this investigation has been undertaken to elaborate studies on airborne algae at Pune.

Pune is a mega city having 160 km distance from Mumbai located towards the southern direction at the Latitude 18°32' N, Longitude 72° 51' E and at Altitude 560m (1840 ft) above sea level. (Map: 1). As a source of airborne algae there are many water resources in and around Pune which contribute to the airborne algae.

Environmental record of meteorological parameters of Pune during study period (from October 2011 to March 2012) have been mentioned below maximum temperature ranging from 28.5<sup>0</sup> -34<sup>0</sup> C, minimum temperature

ranging from  $11^{\circ}$ - $23.9^{\circ}$ C, rainfall (7.2-10 mm) has been recorded only in the month of October 2011, relative humidity ranges from 90-95% and wind velocity 3.2-28.8km/h in the direction of West-East.

## Material and Methods:

Six various sites have been selected from different parts of Pune representing different localities and environments. Air sampling was carried out fortnightly, by riding the two wheeler Activa scooter at the speed of 40-55 km/hr over the roads (Site no. 1 to 6) using petriplate exposure method (Tilak and Anis1989). The Agarised Bold's Basal Medium (BBM) and Chu No-10 have been used in the culture plates from October 2011 to March 2012 during six months season, for culturing the aeroalgal.

Site wise exposed petriplates have been well labeled, sealed and incubated in illuminated culture racks with 40 watt fluorescent tube lights, giving a light intensity of 2000 to 2500 Lux continuously for 24 hrs. in a A/C culture room at  $25 \pm 1^{\circ}$ C temperature for 15 days. The cultures had been frequently enriched with sterilized 2 ml. liquid BBM and Chu No-10 respectively for the enhancement of growth of algae, besides avoiding drying. Petri plates have been observed regularly for the growth of algae and random samples picked up for identification.

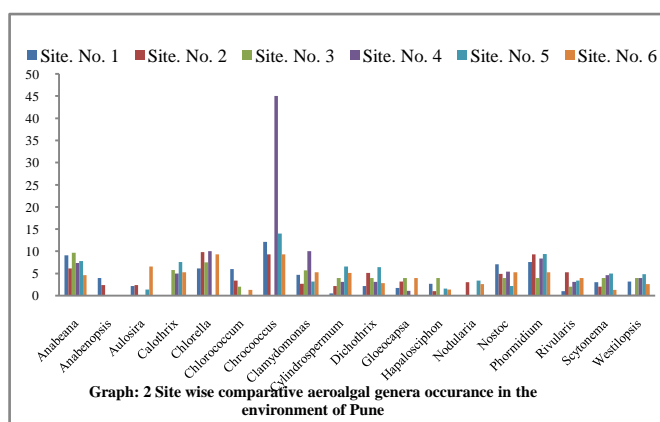
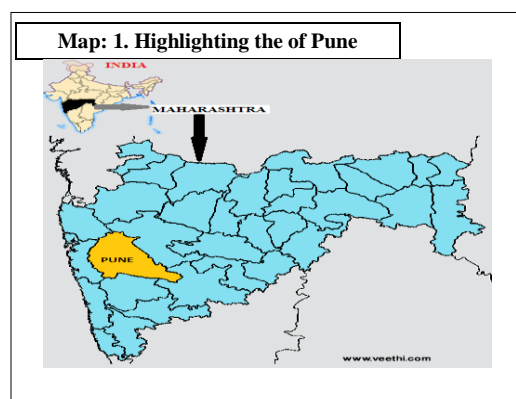
The slides were prepared by mounting little algal material in 50% glycerin, sealed with transparent nail paint and observed under the binocular research microscope using different magnifications. The algal genera and species have been identified on the basis of their morphological characters using authentic literature and reference slides. Sub-cultures have been maintained after isolation.

## Results and Discussions:

Sites no.	Name of the sites
Site no. 01	Nalstope- Karve road- Warje road
Site no. 02	Paud- Pashan- Bavdhan road
Site no. 03	Aaditya Birla Hospital road
Site no. 04	J.M - F.C road
Site no. 05	Sus – University road
Site no. 06	Katraj bypass highway-Sinhagad road

Air sampling was carried out fortnightly for six months; exposing 72 culture plates, randomly selecting 528 colony units have been evaluated. Cyanophyceae members are dominant than the Chlorophyceae and Bacillariophyceae. The investigations at six sites revealed highest percentage contribution of Chroococcus (14.9%) followed by Chlamydomonas 9.96% at Site no. 4 (Mutha River side) and Chlorella 9.96% at Site no. 2 (Pashan Lake) (Table.3 and Graph.2). These two sites have been located near water resources. (Table no.1) Hence it has been proved that these three unicellular algal forms are dominant as compared to colonial and filamentous forms of algae. The unicellular as well as small colonial forms are dominant (Graph.1).

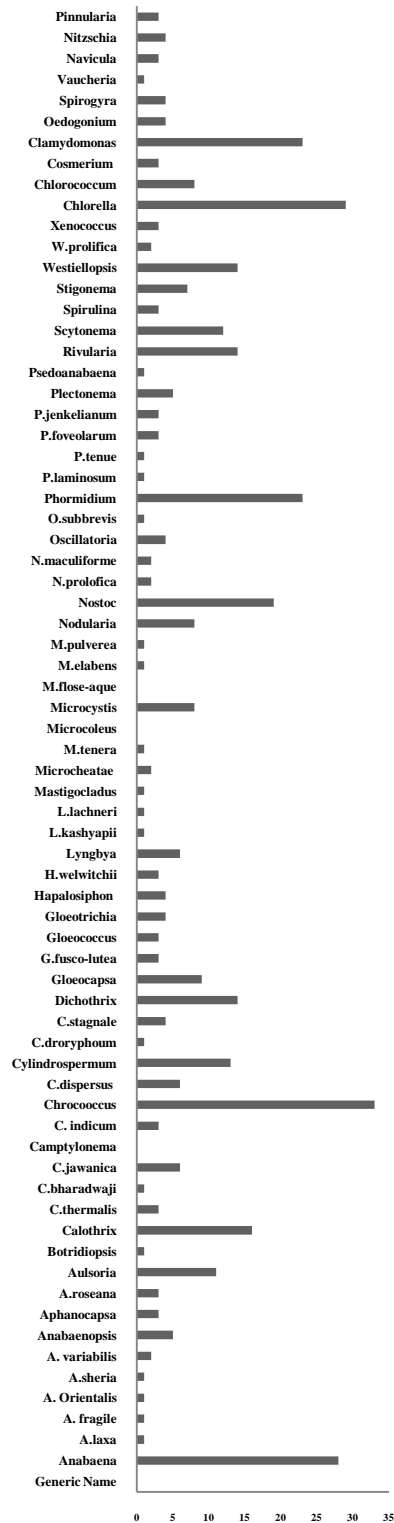
Forty aeroalgal genera have been encountered out of 228 (total record) during this study, including 3 genera as new records for aerobiology in India. These are Camptylonema Sp., Dichothrix Sp. and Psedoanabaena Sp.(Table no. 2)



**Table no.2 Incidence of class wise genera and species at six different sites from October 2011to March 2012**

Sr no	Name of the algae	Sr no	Name of the algae	Sr no	Name of the algae
Cyanophyceae		Chlorophyceae		Bacillariophyceae	
1.	<i>Anabaena sp.</i>	1.	<i>Chlorella sp.</i>	1.	<i>Naviculasp.</i>
2.	<i>A.laxa</i>	2.	<i>Chlorococcumsp.</i>	2.	<i>Nitzschiasp.</i>
3.	<i>A. fragile</i>	3.	<i>Cosmariumsp.</i>	3.	<i>Pinnulariasp.</i>
4.	<i>A. Orientalis</i>	4.	<i>Chlamydomonassp.</i>		
5.	<i>A.sheria</i>	5.	<i>Oedogonium sp.</i>		
6.	<i>A. variabilis</i>	6.	<i>Spirogyra sp.</i>		
7.	<i>Anabaenopsissp.</i>	7.	<i>Vaucheriasp.</i>		
8.	<i>Aphanocapsa sp.</i>				
9.	<i>A.roseana</i>				
10.	<i>AulsoriaSp.</i>				
11.	<i>Botridiopsis.</i>				
12.	<i>Calothrix sp.</i>				
13.	<i>C.thermalis</i>				
14.	<i>C.bharadwaji</i>				
15.	<i>C.jawanica</i>				
16.	<i>Camptylonema sp.</i>				
17.	<i>C. indicum</i>				
18.	<i>Chrocooccus sp.</i>				
19.	<i>C.dispersus</i>				
20.	<i>Cylindrospermum sp.</i>				
21.	<i>C.droryphoum</i>				
22.	<i>C.stagnale</i>				
23.	<i>Dichothrix sp.</i>				
24.	<i>Gloeocapsa sp.</i>				
25.	<i>G.fusco-lutea</i>				
26.	<i>Gloeococcussp.</i>				
27.	<i>Gloeotrichia sp.</i>				
28.	<i>Hapalosiphon sp.</i>				
29.	<i>H.welwitchii</i>				
30.	<i>Lyngbya sp.</i>				
31.	<i>L.kashyapii</i>				
32.	<i>L.lachneri</i>				
33.	<i>Mastigocladus sp.</i>				
34.	<i>Microcheatae sp.</i>				
35.	<i>M. tenera</i>				
36.	<i>Microcoleus sp.</i>				
37.	<i>Microcystis sp.</i>				
38.	<i>M. flose-aque</i>				
39.	<i>M. elabens</i>				
40.	<i>M. pulverea</i>				
41.	<i>Nodularia sp.</i>				
42.	<i>Nostoc sp.</i>				
43.	<i>N. prolofica</i>				
44.	<i>N. maculiforme</i>				
45.	<i>Oscillatoria sp.</i>				
46.	<i>O. subbrevis</i>				
47.	<i>Phormidium sp.</i>				
48.	<i>P. laminosum</i>				
49.	<i>P. tenue</i>				
50.	<i>P. foveolarum</i>				
51.	<i>P. jenkelianum</i>				
52.	<i>Plectonema sp.</i>				
53.	<i>Pseudoanabaena sp.</i>				
54.	<i>Rivularia sp.</i>				
55.	<i>Scytonema sp.</i>				
56.	<i>Spirulina sp.</i>				
57.	<i>Stigonema sp.</i>				
58.	<i>Westiellopsis sp.</i>				
59.	<i>W.prolifica</i>				
60.	<i>Xenococcus sp.</i>				

**Graph .1 Frequency against occurrence of aerophyco genera reported in the atmosphere of Pune city**

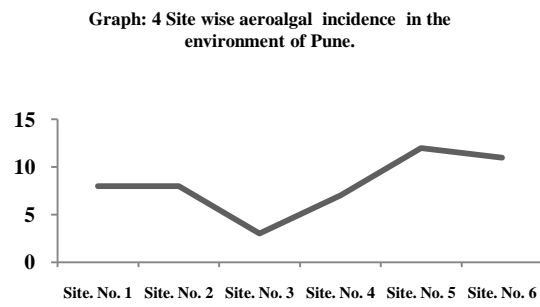


**Table.3 Percentage contribution of dominant aeroalgal types of different six sites of Pune.**

Sr. no	Genus name	Site. No. 1	Site. No. 2	Site. No. 3	Site. No. 4	Site. No. 5	Site. No. 6
1	Anabaena	9.1	6.1	9.7	7.38	7.8	4.6
2	Anabenopsis	4	2.4	0	0	0	0
3	Aulsoria	2.2	2.4	0	0	1.4	6.6
4	Calothrix	0	0	5.8	5	7.6	5.3
5	Chlorella	6.1	9.96	7.5	10	0	9.3
6	Chlorococcum	6	3.4	2	0	0	1.3
7	Chroococcus	12.1	9.3	0	14.9	0	9.2
8	Chlamydomonas	4.7	2.7	5.7	9.96	3.2	5.3
9	Cylindrospermum	0.5	2.2	4	3.1	6.6	5.1
10	Dichothrix	2.2	5.12	4	3.1	6.4	2.8
11	Gloeocapsa	1.7	3.2	4	1.1	0	4
12	Hapalosiphon	2.7	1	4	0	1.6	1.4
13	Nodularia	0	3	0	0	3.4	2.6
14	Nostoc	7.1	4.9	4	5.4	2.2	5.3
15	Phormidium	7.6	9.3	4	8.4	9.4	5.3
16	Rivularia	1	5.3	2	3.07	3.4	4
17	Scytonema	3	2	4	4.6	5	1.3
18	Westiellopsis	3.2	0.2	4	4	4.8	2.6

**Table. 5 Total algal genera count for the selected sites of Pune.**

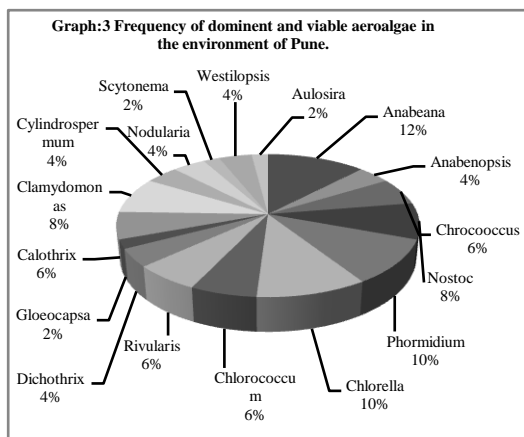
Sites.	Algal genera count
Site. No. 1	8
Site. No. 2	8
Site. No. 3	3
Site. No. 4	7
Site. No. 5	12
Site. No. 6	11



Site wise highest frequency have been recorded for Anabaena (188 out of 528) followed by Chlorella (178 out of 528) and Phormidium (170 out of 528). Only Anabaena was found at all the six sites constantly, Chlorella and Phormidium at 5 sites each, while Gloeocapsa (at Site no.6), Scytonema (Site no. 5) and Aulsoria (Site no.5). Each of them was found only at single site and absent at remaining five sites (Table.4).

The highest incidence was revealed by Anabaena 12% followed by Phormidium and Chlorella 10% each. Lowest incidence was revealed by Gloeocapsa, Scytonema and Aulsoria 2% each. (Graph.3). It has been found that the unicellular, colonial and unbranched filamentous forms like Anabaena and Phormidium are common.

Site wise distribution and dispersion of aeroalgal genera revealed maximum 12 genera at Site no.5 followed by 11 genera at Site no.6 and minimum 3 genera at Site no. 3. (Table.5 and Graph.4)



**Table.4 Frequency of dominant aeroalgal types of different six sites**

Sr. no	Genus name	Site. No. 1	Site. No. 2	Site. No. 3	Site. No. 4	Site. No. 5	Site. No. 6	Out of 528	Incidence for Sites
1.	Anabaena	37	25	40	19	39	28	188	6
2.	Anabenopsis	16	0	0	39	0	0	55	2
3.	Aulsoria	0	0	0	0	40	0	40	1
4.	Calothrix	0	0	24	13	38	0	75	3
5.	Chlorella	25	40	31	26	0	56	178	5
6.	Chlorococcum	24	14	0	0	0	56	94	3
7.	Chroococcus	49	38	0	0	70	0	157	3
8.	Chlamydomonas	19	0	0	26	16	32	93	4
9.	Cylindrospermum	0	0	0	0	33	32	65	2
10.	Dichothrix	0	21	0	0	32	0	53	2
11.	Gloeocapsa	0	0	0	0	0	24	24	1
12.	Nodularia	0	0	0	0	17	16	33	2
13.	Nostoc	29	20	0	14	0	32	95	4
14.	Phormidium	31	38	0	22	47	32	170	5
15.	Rivularia	0	22	0	0	17	24	63	3
16.	Scytonema	0	0	0	0	25	0	25	1
17.	Westiellopsis	0	0	0	0	24	16	40	2

Chroococcus, Chlorella Phormidium, Nostoc and Anabaena have been recorded as overall dominant or site wise dominants in this study.

Chroococcus has been found abundant as also recorded by Sharma and Singh (1992). Chlorella is subdominant algal type also recorded as allergenic (Tilak 1989 and 1992). The other allergenic filamentous forms of Cyanophyceae are Phormidium as also recorded by Sharma and Singh (1989, 1992), Tilak (1992), Nostoc as also recorded by Tilak (1989), Sharma and Singh (1992) and Anabaena as also recorded by Tilak (1989 and 1992), Sharma and Singh (1992).

**Conclusion:**

The environmental conditions and the natural water resources also majorly contributed to the aeroalgal dispersion and viability showing site wise variation. Aeroalgal members have been encountered from

Cyanophyceae, Chlorophyceae and Bacillariophyceae. Out of three classes Cyanophyceae members shows highest count. Most of coccooid unicellular form like *Chlorella* Sp., colonial form like *Chroococcus* Sp., unicellular flagellate form like *Chlamydomonas* Sp. and unbranched filamentous form like *Anabaena* Sp. and *Phormidium* Sp. are viable and very common in dispersion. Environment of Pune shows an aerophyco biopollutents, which may cause allergy in sensitive victims. Thus aerophycoflora is rich and viable in Pune.

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### **References:**

- Chrisostomou A., Moustaka Gouni M., Sgardelis S. and Lanaras T. (2009). Air-dispersal phytoplankton in a Mediterranean river reservoir system (Aliakmon-Polyphytos Greece). *Journal of Planktons Research*. **31(8)**: PP.877-884.
- Desikachary T. V., 1959 *Cyanophyta*. ICRI, New Delhi, PP.686.
- Gregory P.H., Shreeramalu T. (1958). Aerospora of an estuary. *Trance British Mycological Society*. **41(2)**: PP.145-156.
- Jones, J. W, Mcfaddes H. W, Chandler F.W, Kaplan W. and Conner, D. H (1982). Green algal infection in a human, *American Society of Clinical Pathologists*. **80(1)**: PP.102-7.
- Jadhav M. J., Silmia Fatima, Khobragadekshma and Chitra Jain (2006), A preliminary investigation on microflora of rain water at Aurangabad. 'Bioinfolet'; **3 (4)**: PP.328-329.
- Jadhav M. J. and Quazi S. M. (2010). Diversity of airborne algae in the atmosphere of Aurangabad. *Bionanofrontiers*. **3(2)**: PP.287-289.
- John Writton, Brook 2<sup>nd</sup> Edition, (2011). *The fresh water algal flora of British Isles*, Cambridge university press, PP.767.
- Parshwanath H. V. and Ramalingam.(1979). A seasonal variation in the airborne algae over a rural and an urban area. *Current Science*. **48 (21)**: PP.956-957.
- Pandkar J. T and Tarar J. L. (2010). Airborne algal pollutants from a vegetable and fish market at Nagpur. *The Botanique*. **14(1)**: PP.22-27.
- Singh N.I. (1981). Seasonal periodicity of algal forms. *Cytoplasmic algologia*. **11 (2)**: PP.105-108.
- Santra S. C. (1987). Airborne Algae of Calcutta Metropolis. *Phykos*. **26**: PP.71-74.
- Sharma B and Singh N. I. (1992) Cyanophycean air pollutants in the air of Imphal, Proceeding of national symposium on Cyanobacterial nitrogen fixation, PP. 515-520.
- Sharma N. K., Rai A. K., Singh S. and Brown R. M. (2007). Airborne algae their present status and relevance. *Journal of Phycol*. **43**: PP.615-627.
- Tilak S. T. (1983). *Aerophycology- Aspects and Prospects*. All India applied phycological congress Kanpur: PP.11-22.
- Tilak S. T. and Anis Sabia (1989). *Algal aeroflora from Aurangabad*, Special volume, P.P 65-68.
- Tilak S. T. (1992). *Aerophycology*. *Indian Journal of Aerobiology*. **Special Volume**: PP.11-22.

### **Web site referred:**

1. Google maps: 2. Pune meteorological department: