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. recordedcausing 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 raveled 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.

Keywords : Extramural Environment, Viable Algae,

INTRODUCTION

Marvelous contribution of various scientists consequently resulted in the development of aerophycologyas 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.

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Pune is a mega city having 160 km distance from Mumbai located towards the southern direction at the Latitude 18º32' N, Longitude 72º 51' Eand 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 28.5^0 -34^0 C, minimum temperature ranging from 11^0-23.9^0C, 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.

Map: 1. Highlighting the of Pune

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 aeroalgae.

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 Luxcontinuously for 24 hrs, in a A/C culture room at 25 ± 1^{0}C temperature for 15 days. The cultures had been frequently enriched with sterilized 2 ml. liquid BBMand 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 paintand observed under the binocular research microscopeusing 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 & DISCUSSION:

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 Fig. 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 (Fig.1). Fortyaeroalgal 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). Fortyaeroalgal 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: 1 Sites selected for the air sampling from October 2011 to March 2012 at Pune.

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

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).

Table no. 2: Incidence of class wise genera and species at six different sites from Oct. 2011 to Mar. 2012.

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

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 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.	*Rivularis*	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

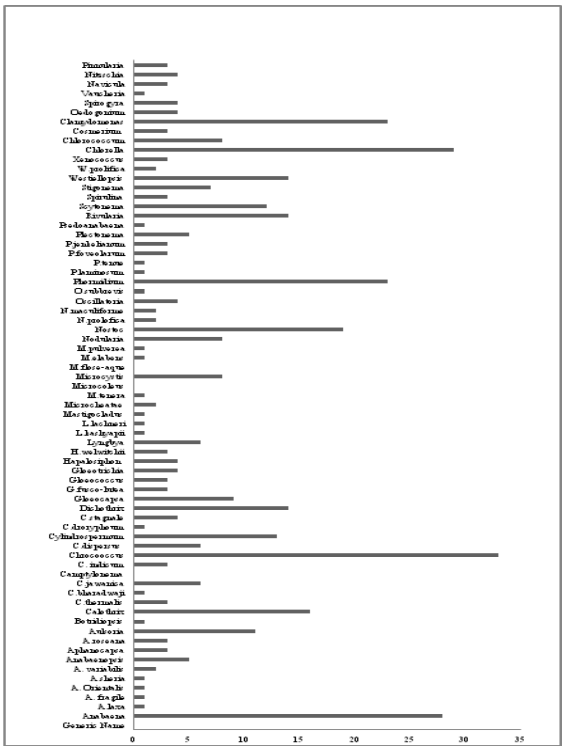

Fig. 1: Frequency against occurrence of aerophyco genera reported in the atmosphere of Pune city

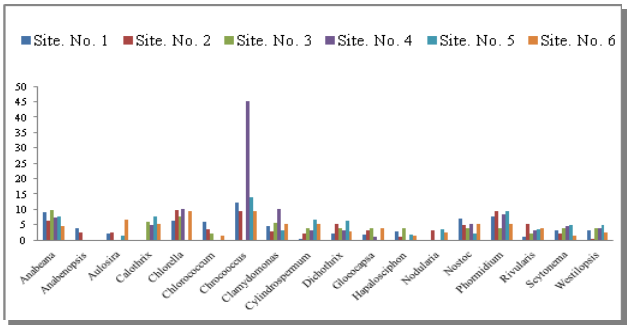

Fig. 2: Site wise comparative aeroalgal genera occurance in the environment of Pune

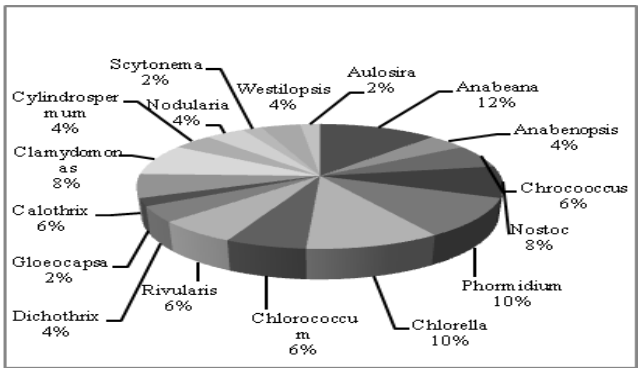

Fig. 3: Frequency of dominent and viable aeroalgae in the environment of Pune.

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

Site	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Algal genera	8	8	3	7	12	11

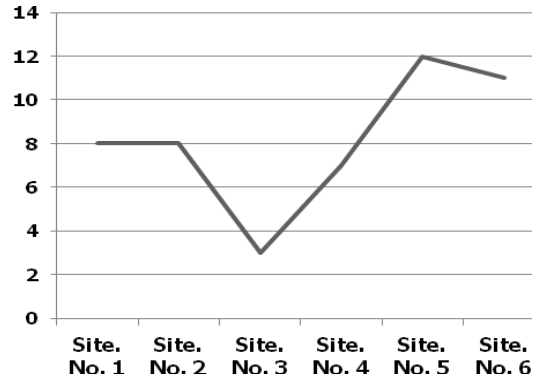

Fig 4: Site wise aeroalgal incidence in the environment of Pune.

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 beenfound that the unicellular, colonial and unbranched filamentous forms like *Anabaena*and *Phormidium*are common.

CONCLUSION:

The environmental conditions and the natural water resources also majorly contributed to the aeroalgal dispersion and viability showingsitewise variation.Aeroalgal members have been encountered from Cyanophyceae, Chlorophyceae and Bacillariophyceae. Out of three classes Cyanophyceae members shows highest count. Most of cocooid 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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