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POPULATION DYNAMICS OF AERO-ALGAL FLORA OF RURAL KANPUR

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ABSTRACT
Ambient air environment of rural Kanpur was monitored during 2009-2010 to assess the population dynamics of the area. In all sixteen algal species were recorded. The most dominant group was Cyanophyceae. Among the genusOscillatoria was most prominent (10.9 % dominance) followed by Spirogyra (8.2% dominance).The least value was ofChlorococcum (4.1% dominance). The highest abundance of aero algae was recorded in April (62.5) the lowest algal count was observed in September (12.5) permutations in meteorological conditions affected the aero algal flora both quantitatively and qualitatively. The significance of aero algal flora observed has been discussed.

INTRODUCTION

Algae are ubiquitous in nature inhabiting almost all possible habitats including air (Mittal *et al.*, 1979; Rosas *et al.*, 1989; Jain and Gupta, 1998; Sharma *et al.*, 2006 and Evelyn Hui-Ping Ng, *et al.*, 2011) the presence of algae in the air has been known since the work of Ehrenberg (1844) who was first to report viable aero algal fragments. Their importance as allergenic agents is also known (Mittal *et al.*, 1979; Gadewar and Tarar 1996; Freeman, 2005; Westrick *et al.*, 2006; Sharma and Rai, 2008; Genitsaris *et al.*, 2011). In India, a few studies carried out on the aero algal flora are those of Tilak and Vishwe (1978); Marathe and Reddy (1980); Santra (1987); Likhitkar and Tarar (1996); Sharma *et al.* (2006). Their role in carrying certain type of respiratory problems hay fever and skin reactions has been recognized (Woodcock, 1948; Heise, 1949; Cox *et al.,* 1974; Genitsaris *et al.,* 2011). Therefore it seemed important to study the dominance and occurrence periodically of aero algae to understand their implications on health hazards. Although air borne algae form a part of bio aerosol they are most understudied. The present study was undertaken to explore the viable algal spores, cysts, akinetes and fragments etc. present in the air of rural area of Kanpur There is only one report on aero algal allergens of Kanpur City (Siddhartha *et al.*, 2010).

Information on air borne algae causing human health problems is scarce. This paper deals with the airborne algae in Kanpur and specially the presence of those aero algae which have been reported as a threat for air quality and human health. This would help in formation of aero allergenic calendar for assisting clinical and therapeutic treatment of affected patients.

MATERIALS AND METHODS

The site selected for the study was Rooma village near Chakeri, Kanpur on Kanpur-Allahabad road approximately 20 kms away from Kanpur. This is an open area of Kanpur with tannery industries and River Ganges nearby. Algal flora of the air was collected by exposing Petriplates containing Chu 10 culture medium (Chu, 1942) solidified with 2% agar, at different sites of the area. Petriplateswere exposed against the wind flow every fortnight, for 24 hrs. The exposed plates were then incubated for 3 to 4 weeks. The algal forms appearing on the culture medium were then carefully picked up and examined microscopically. Algal identification was done with the help of relevant literature on algae (Tiffany and Britton, 1952; Desikachary, 1959; Philipose, 1967; Prescott, 1969).

RESULTS AND DISCUSSION

Table 1 depicts the diverse algal species trapped on culture medium. In all 16 forms were identified of which 7 belonged to Cyanophyceae, 7 to Chlorophyceae and 2 to Bacillariophyceae. On the basis of percentage dominance it can be concluded that *Oscillatoria* was most prominent (10.9%) being present from January to August followed by *Spirogyra* (8.20%) which showed its presence from February to May and then in October and November. *Chlorococcum*showed minimum percentage dominance (4.10%) and was present only in April, Mayand June.

As observed in Fig. 1 the Cyanophyceae was present throughout the year and their presence was more abundant in February, March and April. The peak time being April.

Table 1: 1 Periodic Fluctuation in the aeroalgal flora in Rooma Village of Kanpur

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	% dominance
Cyanophyceae													
Phormidium	A	R	A	A	A	C	C	A	A	C	A	A	5.47
Anabaena	A	A	A	R	A	A	A	R	R	C	A	D	6.80
Aphanothece	A	A	R	A	R	A	A	R	C	C	A	A	6.80
Gleocapsa	R	A	C	A	A	A	A	R	C	A	C	A	6.80
Oscillatoria	R	C	A	A	A	A	R	C	C	D	C	D	10.90
Nostoc	A	A	A	A	A	R	A	A	C	C	A	C	5.47
Lyngbya	A	R	A	A	A	C	D	A	A	R	A	C	6.80
Chlorophyceae													
Actinastrum	A	A	A	A	A	R	C	A	A	R	A	C	5.47
Chlorococcum	A	A	A	A	A	A	A	A	A	C	C	D	4.10
Chlorella	A	A	A	A	A	A	A	A	R	C	C	D	5.47
Chlosterium	A	A	A	A	A	C	C	C	C	A	A	A	5.47
Vaucheria	A	A	A	R	C	C	A	R	A	A	A	A	5.47
Coelastrum	R	A	A	A	R	C	A	R	A	A	A	A	5.47
Spirogyra	A	A	A	C	C	A	A	C	C	C	D	A	8.20
Bacillariophyceae													
Navicula	A	A	A	R	A	C	C	C	A	A	A	A	5.47
Nitzschia	A	A	A	R	C	A	C	A	C	A	A	A	5.47

D = Dominant (> = 50%); C = Common (30%-40%); R = Rare (10%-20%); A = Absent

Chlorophyceaewas absent in the months of August and September. However, it showed three peaks points in December, February and April.Bacillariophyceae was present only between Octobers to March and was maximum in October and January.

On the whole low aero algal population was noticed during July to September (rainy season). It seems probable that due to rains algal cysts, spores, akinetes and other perennating bodies present in the air were washed down and hence their frequency declined. Similar observations were made earlier by Mittal *et al.* (1979) and Rosas *et al.* (1989). In the months of October and November moderate humidity, low temperature, gentle wind and sporadic rainfall favoured the frequency of air algalforms to increase in December(Tilak, 1983; Rosas et al.1989).In January because of peak winters frequency decreased slightly. Temperature became more favourable in February, March and April and aero algal flora was maximum (62.5%) in April. The flora decreased in May and June with increasing temperature.

There have been several surveys of aerophytic algae from different parts of the world (Tiberg *et al.*, 1983; Santra, 1987; Tormo *et al.*, 2001; Genitsaris *et al.*, 2011). Aerophytic algae are permanent constituent of indoor and outdoor

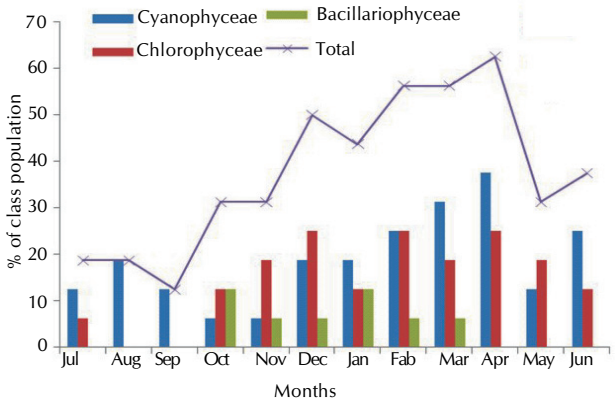

Figure 1: Abundance of algal groups in Rooma Village Kanpur

environments (Tiberg *et al.*, 1983). Among the aeroalgae reported here *Chlorella, Chlorcoccum, Lyngbya, Oscillatoria, Phormidium, Nostoc*, *Anabaena* have been reported to be toxin producers causing allergies (Genitsaris *et al.*, 2011). Sharma and Rai (2008) revealed allergenic nature of *Nostoc* and *Phormidium*. Heise (1949) reported hay fever caused by *Oscillatoria*. Bernstein and Saffermann (1973) confirmed that *Chlorella* and *Chlorcoccum* induce respiratory allergy, nasal and bronchial mucosal secretions. Tiberg and Einarsson, (1989) observed the variable allergenicity of *Chlorella*. Airborne Cyanobacteria have been found to be abundant (Mittal *et al.*, 1979) causing bronchial reactions.

Chlorella, Chlorococcum, Oscillatonia, Nostoc and Nitzschia have been used in air biomonitors (Schlichting, 1971). Due to their easy acclimatization to the atmospheric pollutants, aero algae have proved to better bio indicators than their soil and aquatic counterparts.

Meteorological conditions may be important for release of algae from their natural environment into the new environment (Carson and Brown, 1976) and their survival is affected by rainfall, humidity, temperature and wind (Wee, 1982; Rosas *et al.*, 1989). The spread of allergenic disease depend on periodicity and quantitative abundance of such algae. Distinct correlation of climatic condition and frequency of the algae in the air was noticed by Sharma *et al.* (2007) as also noted in the present study. The study on periodicity and distribution will help in therapeutic treatment of affected patients.

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