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Algal Colonization of the Schirmacher Oasis, Antarctica

RAJAN KUMAR GUPTA and A K KASHYAP

Centre of Advanced Study in Botany
Banaras Hindu University
Varanasi 221 005

Abstract

The principal means of dispersal of microalgae in the Schirmacher Oasis appears to be air currents and through human vectors A number of alga, typically soil algae, were identified as potential colonizers Sample material included dust on equipments, containers loaded on the ship, personal luggage of the expeditioners, life boat of the ship and soil adherent to fresh vegetables imported to Maitn Airborne dispersal within Antarctica was found to disperse algal propagules in the vicinity of Maitn station, although numbers were low The ability of indigenous Antarctic algae and exogenous potential colonizers to survive freeze-thaw cyclcs, high salinity and desiccation will be investigated at home laboratory at Banaras Hindu University.

Introduction

The usual image of Antarctica is an ice-bound continent with a few areas of exposed land (ca. 2%) where solar heating of rock and soil during summer allows the growth of sparse terrestrial life. There are considerable circumstantial evidences that Antarctica receives a steady supply of microbial and bryophyte diaspores from land masses to the north (Walton, 1990). Also the migratory birds might be effective vectors (Schlichting *et al.,* 1978). Since humans set foot in the continent in 1895, it is likely that we have also been vectors for the dispersal of alien microorganisms to Antarctica (Walton, 1990). The need for investigations focussing on the detection and monitoring of exogenous organisms was noted by Rudolph and Benninghouf (1977), but since then there has been little progress (Vincent, 1988). Scientific Community on Antarctic Research (SCAR) has recommended that protection of the Antarctic environment should include the "prevention of the introducing and establishment of non- indigenous species to the greatest extent possible" (Broady, 1992).

Algae are the most wide spread and abundant organisms in terrestrial and aquatic habitats of Antarctic ecosystems. It is, therefore, important to assess the possibility of exogenous algae being dispersed to, and establishing in, these habitats. It has been reported that world wide there are increasing numbers of examples of algae being dispersed to new areas by human and then growing to nuisance proportions. Two examples are the dispersal of toxic marine dianoflagellates in the ballast water of ships (Hallegraeff *et al,* 1988) and the introduction of the fresh water alga "water net" *Hydrodictyon reticulatum* into New Zealand lakes (Caffey and Miller, 1988). Likewise, it is possible that humans could be the vector for the dispersal of algae to Antarctica which might then establish vigorous populations and degrade the scientific value of formerly pristine habitats, as well as change unique continent of great conservation value.

Materials and Methods

I. Analysis of the Propagule Bank of Snow and Ice

Ice and snow was collected using asceptic precautions. Sample was melted and filtered through membrane filters (micropore filters) and was examined microscopically for the presence of recognisable algae and was also used for inoculating cultures. For inoculation, the filters laid on the surface of the moist sterilized soils and on the surface agarized mineral salt media (BG-11) (Rippka *et al, 1979*) and incubated in BOD incubator at 20 - 25°C for four to five days and observations were made under the microscope.

II. Analysis of the "Propagule Bank" of Soils

The algal flora in the vicinity of Maitri station and at other sites of Schirmacher Oasis was analysed floristically using direct microscopic examination of samples, and using "moist plate enrichment cultures" and mineral salt nutrients.

III. The Detection of Non-indigenous Algae Brought to Antarctica by Human Vectors

Samples were taken from following: containers, scapping from people's shoes, clothes, equipments, ship, fresh vegetables used in the station soil from the house plants (green house). Samples were examined under microscope and inoculated using following techniques.

(a) agarized media (BG-11 + N)

(b) liquid mineral salt nutrient (BG-11 + N)

(c) moist plate enrichment cultures using salts from green house of Maitri as substrata.

IV. The Detection of Airborne Algae

Sticky slides were used for trapping the airborne algal propagules at various sites and investigated under microscope.

V. Test for the Ability of Airborne Algae to Colonise Soils

Moistened sterile soil was exposed to the atmosphere for standard periods (2-24 h). Petri dishes containing mineral nutrient medium and also soil were placed at various sampling sites in order to the optimise the deposition of propagules onto the soil surfaces. After the exposure the soil surfaces were covered and treated as moist plate enrichment cultures i.e., incubated in the light at warm temperature (20±5^{o}C). The developed algae was identified under microscope.

Results

A. The Potential Antarctic Colonizers

The various algal species belonging to the three classes of algae i.e., Cyanophyceae, Chlorophyceae and Baccilariophyceae were identified out of which most of the algae belong to Cyanophyceae (Table 1)

B. Establishment of Exogenous Algae

Direct microscopic examination of macroscopic growth of algae occurring in vicinity of Maitri station as well as culture studies of some other sites did not reveal the presence of exogenous algae. The algal species detected have also been recorded previously from Maitri station and vicinity. However, because all were identified only to generic level it is not yet possible to make sure with regard to their simmilarity at species and intraspecific levels. Samples have been collected and further identifications are being made at home laboratory at BHU.

C. Dispersal of Algae by Human and Natural Vectors in Antarctica

A postulated dispersal pathway of algae to and within Antarctica has been presented in Fig. 1. Despite of using a large number of sticky slides for the arrival of airborne diaspores, very few have been detected. None were found

Table 1 : Potential Antarctic Colonizers

A.	**Cyanophyceae**		
	1.	Nostocales	
			Nostocaceae
			Oscillatoria
			Nostoc
			Phormidium
			Lyngbya
			Calothrix
			Schizothrix
			Tolypothrix
	2.	Chroococcales	
			Gloeocapsa
			Aphanocapsa
			Aphanothece
			Chroococcus
B.	**Chlorophyceae**		
	1.	Chlorococcales	
			Chlorococcum
C.	**Baccilariophyceae**		
	1.	Pennales	
			Naviculoideae
			Pinnularia
			Nitzschoideae
			Hantzschia

in Dakshin Gangotri region. Only three have been recorded in Maitri region which are *Cosmarium, Oscillatoria, Phormidium* sps.

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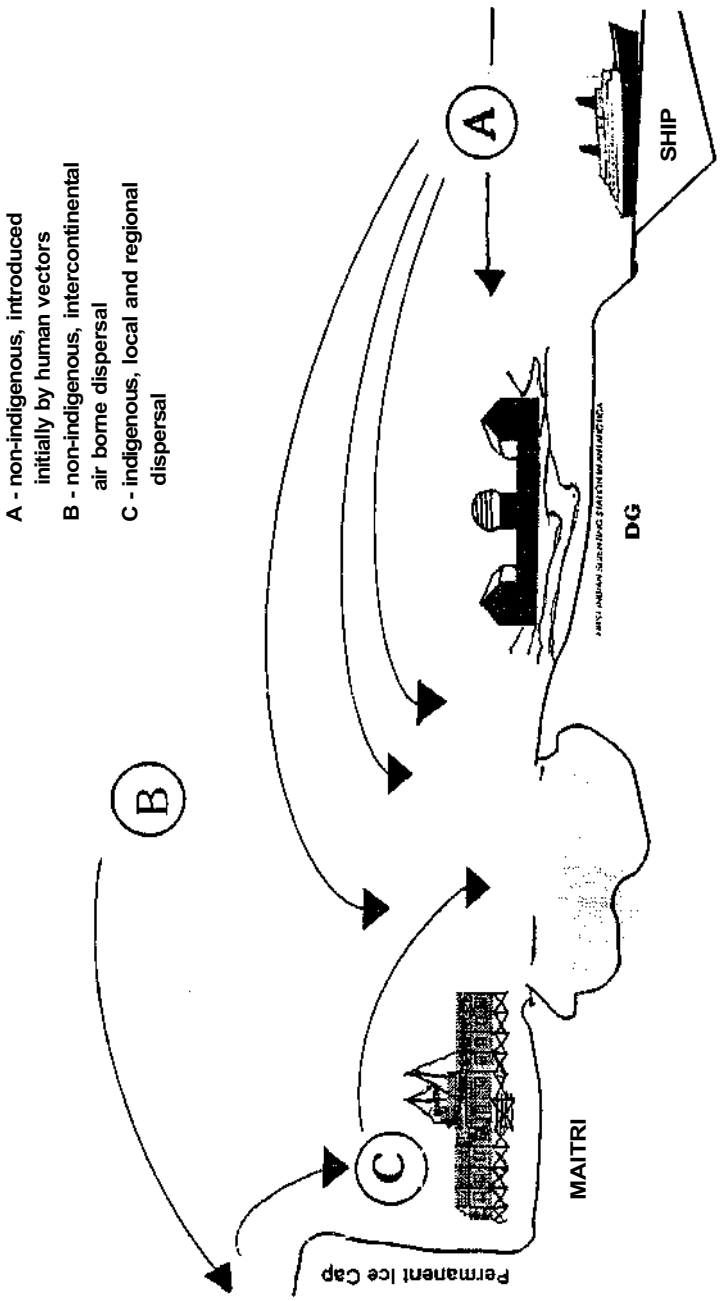

Fig. 1: Postulated Dispersal Pathways of Algae to and within Antarctica

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