WIND DISPERSAL OF TERRESTRIAL ALGAE AT SIGNY ISLAND, SOUTH ORKNEY ISLANDS

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ABSTRACT. Viable algae, fungi and bacteria were recovered on nutrient agar surfaces exposed to the prevailing wind at Signy Island, South Orkney Islands. Most colonies were produced during summer exposure when there was no extensive snow cover over the coastal lowland. The algae were all recorded in terrestrial habitats at Signy Island and there was no evidence for the input of potential colonists from other areas. It is suggested that all terrestrial algae at Signy Island have the opportunity to colonize most terrestrial habitats largely by airborne dispersal.

THE local dissemination of plant propagules in Antarctica has received little attention, although long-distance dispersal has been cited as important to Antarctic plant colonization (Rudolph, 1970). Plant fragments captured by sticky slides and on agar surfaces at Cape Hallett, Victoria Land, and in the Fosdick Mountains, Marie Byrd Land, were examined by Rudolph (1970), and Cameron and Benoit (1970) recovered bacteria on exposed agar surfaces at Deception Island, South Shetland Islands. The results of the present investigation were obtained during a survey of terrestrial algae at Signy Island, South Orkney Islands (lat. 60°43′S., long. 45°38′W.) between 1971 and 1974.

METHODS

Petri plates 9 cm. in diameter containing 25 ml. of Bold's modified Bristol's medium (Chantanachat and Bold, 1962) solidified with 2 per cent agar were attached with their agar surface in a vertical position at the top of a 1 m. high stake. The stake was positioned on Berntsen Point, *c.* 20 m. a.s.l., about 200 m. north-east of the British Antarctic Survey research station in Factory Cove, Signy Island. Two plates were exposed on each of nine occasions from March to December 1973 for periods of from 1·5 to 26 hr. Before removal of the lids the agar surfaces were directed into the wind. On termination of the exposure the sterile lids were replaced over the plates for transport to the laboratory. Incubation was at room temperature (*c.* 18° C) in light supplied from four 30 W daylight fluorescent tubes for 3 weeks, at the end of which period the plates were examined for growths of algae, fungi and bacteria. The number of growth origins of algae was counted and these were removed for microscopic examination and identification.

RESULTS

Micro-organisms appeared on the plates on seven occasions, while no recovery was obtained for the two sample periods in early October 1973 (Table I). Because of the varying lengths of exposure time, the number of origins of algal growth on the plates has been expressed as numbers $m.^{-2}$ of agar surface $hr.^{-1}$ of exposure. Between 26 July and 8 October, when there was extensive winter snow cover over lowland coastal areas, bacteria were not recovered and only one algal colony occurred on the plates. Maximum recovery of algae occurred on three summer occasions, 10 April, 25 October and 26 December, when there was little snow on the lowlands. On the first two summer occasions the exposure time was short, giving little opportunity for impaction of algal propagules on the agar surface. Before extensive snow melt on 1 and 8 October, even long exposure periods did not produce microbial growth, whereas after snow melt there was a recovery of all three groups with much shorter exposure periods.

Algal growth frequently appeared around particles of soil and macroscopic fragments of vegetation deposited on the plates and often each origin of algal growth consisted of more than one species. Algae were therefore distributed adhering to wind-blown particles and also

TABLE I. FREQUENCY OF RECOVERY OF VIABLE MICRO-ORGANISMS ON EXPOSED AGAR SURFACES AT SIGNY ISLAND

Date 1973	*Length of exposure* (hr.)	*Snow cover**	*Presence or absence of micro-organisms*			*Number of origins of algal growth m.$^{-2}$ of agar surface hr.$^{-1}$ exposure*
			Algae†	*Fungi*	*Bacteria*	
3 March	1·5	—	—	—	+	0
9 March	2	—	—	+	+	0
10 April	16	—	+ (8)	—	+	16
26 July	12	+	—	+	—	0
24 September	17	+	+ (1)	+	—	4·6
1 October	25	+	—	—	—	0
8 October	26	+	—	—	—	0
25 October	9	—	+ (42)	+	+	369
26 December	6	—	+ (7)	+	+	92

*The presence of an extensive snow cover over lowland coastal areas which are usually exposed in summer is indicated by (+).
†The figures in parentheses are the number of origins of algal growth developing on the agar surfaces after incubation.

possibly as single cells. On 25 October there were considerable amounts of moss, lichen and foliose alga (*Prasiola crispa* (Lightf.) Menegh.) on the surface of a nearby snowdrift and it was apparent that the strong wind (*c.* 13 m. sec.$^{-1}$) which was blowing when the plates were exposed was responsible for transporting much of this debris.

The algae recovered (Table II) were either members of the Xanthophyceae, Euchlorophyceae or Ulothricophyceae and were all recorded as common components of the terrestrial algal flora of Signy Island in soils and amongst vegetation (Broady, 1979*b*). Members of the Cyanophyceae and Bacillariophyceae were not recovered although they too were frequently found in soil. However, it was found (Broady, 1979*b*) that they generally did not produce growth on Bold's modified Bristol's medium, and it is therefore quite likely that they also impacted on the exposed plates but did not develop macroscopic growths.

DISCUSSION

At Signy Island the quantities of terrestrial algae in the air appeared to be related to the extent of the lowland snow cover. When the lowland area, which provides habitats for extensive growth of cryptogamic vegetation, is without snow cover, fragments of vegetation and soil are readily dislodged and carried by the frequent strong winds. This can be observed in summer when quite large fragments of lichens, mosses and *Prasiola crispa* are blown on to previously clean areas of snow. The last two sampling occasions (25 October and 26 December) had recovery rates of 369 and 92 algal propagules m.$^{-2}$ hr.$^{-1}$, respectively, which were considerably higher than the 0·74 plant propagules m.$^{-2}$ hr.$^{-1}$, of which 85 per cent were algae, recovered on sticky slides at Cape Hallett, Victoria Land, by Rudolph (1970). With such large quantities of terrestrial algae in the air at Signy Island, it is likely that most taxa will be distributed to all the available habitats on the island and will thus have the opportunity to colonize all of these. Additional dispersal in melt-water streams (Broady, 1977), over short distances in collembolan guts and faeces (Broady, 1979*a*), on the feet of penguins and other birds, on the bodies of seals and by human vectors will also aid this process. However,

TABLE II. VIABLE ALGAE RECOVERED ON EXPOSED AGAR SURFACES AT SIGNY ISLAND

*Algae**	*Dates of exposure of agar surfaces*			
	10 April 1973	24 September 1973	25 October 1973	26 December 1973
Xanthophyceae				
Botrydiopsis constricta Broady	−	−	+	−
Gloeobotrys terrestris Reisigl	+	−	−	−
Heterococcus chodati Vischer	−	−	+	−
Heterothrix debilis Vischer	−	−	−	+
Heterothrix exilis Pascher	−	−	+	+
Monodus subterraneus Boye Petersen	+	−	−	−
Unidentified genus of the family Pleurochloridaceae	−	−	+	+
Euchlorophyceae				
Chlamydocapsa sp. A	−	−	+	−
Chlorella vulgaris var. *autotrophica* (Shihira and Krauss) Fott and Novakova	−	+	−	−
Chlorococcum sp.	+	−	−	+
Ulothricophyceae				
Chlorhormidium flaccidum (A. Braun) Fott	+	−	−	−
Stichococcus bacillaris Naegeli	+	−	+	+

*Descriptions and illustrations of the algae have been given by Broady (1979*b*).

the recorded patterns of distribution for the terrestrial algal flora, in which many taxa are restricted to particular habitats (Broady, 1979*b*), emphasizes that considerable environmental pressures must be present in order that such a mosaic of distribution be established.

Previous studies (Brown and others, 1964; Behre and Schwabe, 1970) have also shown that most airborne algae are derived from soil. Whether soil algae from nearby continental landmasses are distributed by air currents to Signy Island requires further study, as no taxa which are not found in terrestrial habitats at Signy Island were recovered from the air in the present study. Heal (1967) reported that nutrient agar plates exposed at Signy Island produced cultures of fungi and bacteria not detected in the island's soil micro-flora, and it is therefore likely that there is also a constant input of potential algal colonists which, if deposited in a suitable niche, would become established. Behre and Schwabe (1970) found mostly typical soil forms amongst the 106 taxa of algae recovered at Surtsey Island, Iceland, soon after its volcanic eruption. Most of these must have reached the island by aerial transport and all were also recorded from nearby Iceland. It is necessary to establish whether there are affinities between the Signy Island algal flora and the algae of the nearest landmasses of the Antarctic Peninsula and southern South America before the importance of long-distance airborne dissemination can be evaluated.

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