THE SIGNY ISLAND TERRESTRIAL REFERENCE SITES: II. THE PROTOZOA

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ABSTRACT. Studies on the Protozoa of the moss-turf and moss-carpet reference sites on Signy Island have revealed 50 species: 16 Mastigophora, 17 Testacida, and 17 Ciliata. Determinations of the mid-winter and mid-summer population sizes suggest that flagellates and testates constitute almost the total fauna, with ciliates very rare and Amoebae entirely absent.

FOLLOWING the creation of the reference sites on Signy Island (Tilbrook, 1973), a series of six cores was taken from each site in order to determine the composition of their protozoan fauna. Estimates were made of the abundance of all groups of Protozoa in site 1 (moss turf) in mid-winter (July 1970) and mid-summer (January 1971). An estimate of the numbers of Testacida only in site 2 (moss carpet) was made in late summer (March 1971). Data on environmental conditions at the time the cores were taken are abstracted from a series of regular measurements made on the moss turf of site 1. Data for site 2 were taken only on the one sampling occasion in March 1971.

METHODS

Samples were taken with a steel corer 2·5 cm. in diameter. The cutting edge was toothed and could be attached to a brace and bit for sampling peat frozen hard in winter. The 0–9 cm. horizon of each core was stored for laboratory examination.

The species of flagellates, Amoebae and ciliates in the cores were determined by culture methods. Sterile petri dishes were used with a base of peat extract agar, seeded with *Aerobacter aerogenes* (NCIB strain 418) as food supply for the Protozoa. Approximately 2 g. of each core were inoculated on to the agar, moistened with sterile 0·5 per cent NaCl and incubated at 12° C. The cultures thus established were examined microscopically for Protozoa after 1, 3, 7, 15 and 30 days' incubation. A final examination was made between the fiftieth and sixtieth days. Species were identified morphologically and a species list was built up of the fauna of each site.

Numbers of active and encysted flagellates, Amoebae and ciliates were determined by a dilution-culture method (Singh, 1955). The same culture conditions were used as for the species determination cultures. From the number of positive cultures, numbers of Protozoa per gram of moss peat fresh weight were estimated by Fisher's method (Fisher and Yates, 1963).

A direct examination technique was used to determine the numbers and species of testates (Couteaux, 1967). Standard aliquots of a suspension of Bouin-fixed peat at 1/1,000 dilution were passed through membrane filters; the filters were cleared and mounted on slides, ten replicates for each estimation. Testate species were identified from the morphology of the test and counted. From these, species lists were compiled and numbers estimated.

The pH's of the cores were determined electrometrically; moisture by oven drying at 100° C for 48 hr.; loss on ignition, a crude measure of organic content, by ashing in a muffle furnace at 450–500° C for 10 hr.

RESULTS

Composition of the fauna

		Site 1	*Site 2*
CLASS MASTIGOPHORA			
SUB-CLASS PHYTOMASTIGIDA			
Order Chrysomonadida	*Cephalothamnium cyclopum* Stein	+	—
	Oikomonas mutabilis Kent	+	+
	Oikomonas termo Ehrenberg	+	+
	Polypseudopodius bacterioides Pusch	+	+
Order Euglenoidida	*Petalomonas angusta* Klebs	+	—
	Petalomonas mediocanellata Stein	+	+

		Site 1	Site 2
SUB-CLASS ZOOMASTIGIA			
Order Protomonadida	*Bodo celer* Klebs	+	+
	Bodo saltans Ehrenberg	+	−
	Cercobodo vibrans Sandon	+	+
	Cercomonas crassicauda Alexeieff	+	+
	Cercomonas longicauda Stein	+	−
	Heteromita globosa Stein	−	+
	Heteromita lens Muller	+	−
	Heteromita obovata Lemmermann	−	+
	Spongomonas uvella Stein	+	+
Order Polymastigida	*Spironema multiciliata* Klebs	+	−
CLASS SARCODINA			
SUB-CLASS RHIZOPODA			
Order Amoebida	(None detected)		
Order Testacida	*Arcella vulgaris* Ehrenberg	+	+
	Assulina muscora Greeff	+	+
	Clypeolina sp. Penard	−	+
	Corythion dubium Taranek	+	+
	Difflugia penardi Wailes	+	+
	Difflugiella sp. Cash	+	+
	Diplophrys archeri Barker	+	−
	Euglypha ciliata (Ehrenberg) Leidy	+	−
	Heleopera sp. Leidy	−	+
	Hyalosphenia elegans Leidy	+	−
	Lecythium hyalinum (Ehrenberg) Hertwig and Lesser	+	−
	Nebela wailesi Deflandre	−	+
	Parmulina cyathus Penard	+	−
	Phryganella acropodia Penard	+	+
	Pseudodifflugia gracilis Schlumberger	+	−
	Trinema enchelys (Ehrenberg) Leidy	+	−
	Trinema lineare Penard	+	+
CLASS CILIATA			
SUB-CLASS HOLOTRICHIDA			
Order Gymnostomatida	*Enchelys* sp. Hill	+	+
	Holophrya sp. Ehrenberg	+	−
	Lagynophrya sp. Kahl	+	+
	Litonotus sp. Wresniowski	+	−
	Urotricha agilis Stokes	+	+
Order Trichostomatida	*Leptopharynx sphagnetorum* (Levander) Mermod	−	+
	Microthorax simulans (Kahl) Engelmann	−	+
Order Hymenostomatida	*Cyclidium glaucoma* Muller	−	+
	Glaucoma pyriformis Ehrenberg	−	+
Order Peritrichida	*Vorticella striata* Dujardin	+	−
SUB-CLASS SPIROTRICHIDA			
Order Oligotrichida	*Halteria grandinella* (Muller) Dujardin	+	−
Order Hypotrichida	*Gonostomum affine* Stein	+	−
	Oxytricha fallax Stein	−	+
	Oxytricha pellionella (Muller) Ehrenberg	+	+
	Oxytricha setigera Stokes	−	+
	Pleurotricha lanceolata (Ehrenberg) Stein	+	−
	Uroleptus sp. Ehrenberg	+	−

	Site 1	*Site 2*
NUMBER OF SPECIES	39	30
	50	

Numbers of Protozoa

Site 1

MASTIGOPHORA

		Number/g. peat fresh weight with 95 per cent confidence limits	*Number/cm.² with 95 per cent confidence limits*
July 1970	Active	60 (0–360)	540 (0–3,100)
	Encysted	690 (560–850)	5,930 (4,830–7,270)
	Total	760 (620–930)	6,460 (5,270–7,930)
January 1971	Active	780 (430–1,160)	4,410 (2,460–6,580)
	Encysted	490 (400–600)	2,780 (2,260–3,410)
	Total	1,270 (1,040–1,560)	7,190 (5,870–8,840)

AMOEBIDA None detected.

TESTACIDA

	Peat horizon	*Number/g. peat fresh weight ± 95 per cent confidence limits*	*Number/cm.² ± 95 per cent confidence limits*
July 1970	0–3 cm.	950 ± 390	2,630 ± 1,090
	3–6 cm.	950 ± 310	2,750 ± 900
	6–9 cm.	2,200 ± 560	6,360 ± 1,630
	0–9 cm.	1,370 ± 420	11,740 ± 3,620
January 1971	0–3 cm.	11,450 ± 2,250	11,800 ± 2,300
	3–6 cm.	11,200 ± 1,700	12,540 ± 1,900
	6–9 cm.	8,400 ± 1,140	10,520 ± 1,430
	0–9 cm.	10,350 ± 1,700	34,860 ± 5,630

CILIATA No estimate.

Site 2

MASTIGOPHORA No estimate.

AMOEBIDA None detected.

TESTACIDA

	Peat horizon	*Number/g. peat fresh weight ± 95 per cent confidence limits*	*Number/cm.² ± 95 per cent confidence limits*
March 1971	0–9 cm.	4,050 ± 780	31,150 ± 6,010

CILIATA No estimate.

Environment

Site 1

Vegetation: *Polytrichum alpestre; Chorisodontium aciphyllum*
Means ±95 per cent confidence limits (six replicate measurements)

	Peat horizon	*pH*	*Percentage moisture*	*Percentage loss on ignition*
July 1970	0–3 cm.	4·1±0·1	596±50	96·8±0·9
	3–6 cm.	4·1±0·1	673±121	96·4±0·8
	6–9 cm.	4·0±0·3	662±19	96·2±0·9
January 1971	0–3 cm.	3·5±0·3	215±20	96·0±0·7
	3–6 cm.	3·7±0·2	311±37	95·3±1·1
	6–9 cm.	3·9±0·2	333±28	93·7±1·6

	Temperature °C at times of sampling				*Snow depth*
	Air height 1·5 m.	*Moss surface*	*Peat depth 1·5 cm.*	*Peat depth 4·5 cm.*	*Observed range from six poles*
July 1970	−7·5	−6·0	—	—	8–45 cm.
January 1971	+1·3	+8·6	+7·7	+5·0	0 cm.

Site 2

Vegetation: *Drepanocladus uncinatus; Calliergon* sp.
Means ±95 per cent confidence limits (six replicate measurements)

	Peat horizon	*pH*	*Percentage moisture*	*Percentage loss on ignition*
March 1971	0–3 cm.	4·7±0·2	955±116	93·6±3·4
	3–6 cm.	4·6±0·1	715±226	92·0±3·9
	6–9 cm.	4·6±0·1	540±97	85·2±2·8

Discussion

These results indicate that the moss-turf and moss-carpet reference sites contain a fauna similar to that of acid moorland soils in northern temperate and arctic regions (e.g. Heal, 1962; Couteaux, 1969; Stout, 1970), though species diversity is reduced. The complete absence of *Colpoda* spp. is particularly remarkable as this is frequently cited as the commonest of all soil ciliate genera (Sandon, 1927; Stout and Heal, 1967). This absence is at present unexplained. The testate species found are similar to those recorded by Penard (1911), Decloitre (1960), Sudzuki (1964) and Heal (1965) from various sites in the Antarctic.

Geographical barriers appear to have little effect on the dispersal of Protozoa; it is likely that the fauna of Signy Island is determined by local ecological factors. Even the genus *Nebela*, which does show a convincing zoogeography (Decloitre, 1954), is here represented only by a cosmopolitan species *N. wailesi*.

The numbers for site 1 show that the main elements of the fauna are flagellates and testates. Whilst the ciliates show considerable species diversity, the failure to obtain any quantitative estimates for this group suggests that their numbers must be very low. The mid-summer numbers of flagellates are considerably lower than expected. A count performed on cores from another *Polytrichum–Chorisodontium* turf on Signy Island in January 1969 gave the result: 12,740 active and 530 encysted cells per gram fresh weight. The low numbers for January 1971 may be due to the dryness of the peat at this time.

Lack of simultaneous data for sites 1 and 2 prevents conclusive comparisons being drawn. The data available suggest that, despite a considerable difference in moisture content, site 2 contains a testate fauna very similar to that of site 1 in numbers and species composition.

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