On the Terrestrial Microfauna of Surtsey During the Summer 1970

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INTRODUCTION

In August 1970 B. Pejler accompanied Prof. C. H. Lindroth on his expedition to Surtsey. On the way to the island Dr. G. H. Schwabe joined us and showed us the localities of the first known plant settlements above the highest water-line, found by him in previous years and described in earlier communications (see Behre and Schwabe 1970, with references). Some samples were collected from these patches of algal and moss vegetation for investigation of the microfauna.

DESCRIPTION OF THE LOCALITIES

Only the localities where microzoa were encountered are mentioned here. On all observation occasions the cultures from several localities were found to contain only algae, while others showed no organisms at all.

In most cases the animals reported were observed in all the cultures from the localities where they were found. In cases where our locality is the same as one of Schwabe's, the number used by him is mentioned within brackets after our designation.

The localities S 14 and S 18 are situated in the lava area, below the highest water-line, S 22 in the lowest part of the passage between the tephra cones of Surtur I and Surtur II, straight W of the "New Year Crater". All other localities are situated in the crater area of Surtur II, on tephra ground, close to steam exhalations.

Some details concerning the localities:

S 7 (315) 1 m S of the fenced (preserved) area. Dense growth of mosses.

S 8 (307-308) Surface layer (2 mm) of a dried-up pool.

S 14 (319) Just above the water-line (and at times flushed by the waves). With sporulating moss. Possibly manured by birds.

S 18 (329) Lava cave, ca. 200 m E of Klofi, about 30 m above sealevel. Moss-covered area at least 100 cm^2.

S 20 (333) "The Bell", a crater forming a bell-shaped cave, into which the light penetrates only from one direction, although the insolation is rather weak because of a "misty curtain" of condensed steam. The illuminated wall was densely covered by moss (the most intense and extended vegetation observed anywhere on Surtsey this year). The internal walls were dripping with water and had a temperature of +20°— +40°C.

S 21 (334 a) Moss patch ca. 10 m below "The Bell", on a rather steep slope. The tephra substrate was rather firm, moist and somewhat heated.

S 22 "Scatella-locality", so-called owing to the finds of imagines of *Scatella tenuicosta* Coll. (Ephydridae, Diptera, det. Hugo Andersson). The tephra substrate relatively firm, soaked with condensed water and with a discernible layer of blue-green algae.

S 27 Moss patches immediately E of the fenced area (cf. S 7).

METHODS

The samples were taken to the Institute of Plant Physiology in Uppsala under sterile conditions, where they were inoculated (one week after the collection) to either firm substrates (agar), or a liquid nutrient solution (8 cultures

from each sample). The last-named cultures were also used to determine the nitrogen fixation. The composition of the medium is given in Henriksson, Henriksson & Pejler 1971. The cultures were kept in a chamber with controlled conditions, +20°C and about 3000 Lux and with a humidity balanced in order to avoid exsiccation. Renewed inoculation (in order to get a "fresh" substrate) was made on Nov. 20, 1970 and on April 5, 1971. Microscopic examination was made at intervals from August 1970 to May 1971.

All measures were taken in order to avoid contamination of the samples and the cultures. Most species were found in several cultures, and in such cases, at least, their occurrence on Surtsey ought to be considered as certain. In some cases, however, only single observations were made, which is designated in the table with an asterisk. However, also in these cases the risk of contamination is considered as being small (cf. Behre and Schwabe, op. cit., pp. 41 and 65).

COMMENTS ON THE TAXONOMY

The taxonomy of the nude amoebae is far from definite, different authors having different ideas concerning the separation of species and genera, owing to the extremely high individual variability, for example. The characters exhibited depend to a high degree on the environmental conditions, and it is thus often impossible to compare the material with the results of authors using other culture methods or making direct observations (moreover, the environmental conditions are often not mentioned in the literature). Therefore, in several cases it is meaningless to mention the names of the species, even if the forms are in complete agreement with descriptions found in the literature. In such cases species names are omitted. The determinations are based on lengthy observations on several individuals in order to get a picture, as complete as possible, of the different phases. Concerning the rhizopods we mainly follow the exposition by Harnisch (1960), from which we sometimes deviate, however, when it is necessary to get the taxonomy more up to date.

Concerning the designation of the *Habrotrocha* form, Donner will give more detailed comments in a future paper on Bdelloidea.

COMPOSITION OF THE FAUNA IN 1970

The observations made in the different cultures are presented in Table 1. The nematode reported by Sohlenius (1972) was also encountered in cultures reared from samples collected in 1971 by G. H. Schwabe. As far as can be judged from the literature, the forms observed are widespread, often cosmopolitic, and capable of enduring severe environmental conditions. Some of them, for example, are reported from the Antarctic (Dillon, Walsh and Bierle 1968, Donner 1965). Studies of the literature suggest that all animals observed are able to reproduce asexually or parthenogenetically, at least temporarily. In most species the whole animal can be rapidly transformed into a resting stage capable of exsiccation, freezing and distant dispersal (see, e.g., Kahl 1930, Grospietsch 1965, Donner, op. cit., Sohlenius, op. cit.).

CHOICE OF FOOD

Table 2 shows the observations of food intake, as well as corresponding data found in literature. Of course this exposition implies that other types of food can also be utilized. Thus, it is highly probable that bacteria also play an important role for the amoebae concerned. It is true that no such ingestion was observed, but bacteria-like structures were often found in their interiors.

Regarding the grazing effect, the material does not, of course, permit any conclusion, but it should be pointed out how voracious some of the amoebae were found to be, *Thecamoeba* sp., for example, being usually stuffed with blue-green algae.

As far as the amoebae are concerned it was quite obvious that moving objects were not ingested. All animals observed, as far as can be judged, are herbivorous. In other words, the ecological pyramids of the small eccosystems concerned should be formed by only two trophic levels.

APPENDIX: SOME FINDS FROM FRESHWATER ENVIRONMENTS

Samples were collected from traps (plastic tanks) originally set out by B. Maguire. In addition to some of the forms already reported by this author (Maguire 1970) the species mentioned in Table 3 were also detected. They were observed by direct microscopic examination. The nematodes discussed by Sohlenius (op. cit.) were also found in trap No. 4.

ABSTRACT

Samples of moss and algal vegetation from the island of Surtsey/Iceland were cultured on both solid and liquid substrates. About ten different microzoa were found, belonging to Rhizopoda, Ciliata, Rotatoria and Nematoda. They are all

characterized by great resistance to environmental extremes, wide distribution and a way of propagation (asexual etc.) which enables distant dispersal. Only vegetable matter (algae, bacteria) was observed to be eaten by all these forms.

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TABLE 1

Occurrence of the forms in the different localities during 1970

Locality	S 7	S 8	S 14	S 18	S 20	S 21	S 22	S 24	S 27
RHIZOPODA, AMOEBINA									
Vahlkampfia, limax-type	×					×		×	
Vahlkampfia, guttula-type*			×						
Naegleria soli Mart. and Lewin	×	×							×
Naegleria bistadialis Puschkarew	×			×					×
Trichamoeba sp.*								×	
Mayorella vespertilio Penard*									×
Dactylosphaerium sp.		×		×					
Vexillifera ambulacralis Penard*								×	
Astramoeba stella Schaeffer		×		×	×				
Astramoeba sp.							×		
Thecamoeba striata Penard*									×
Thecamoeba sp.			×				×	×	
Nuclearia sp.*		×							
RHIZOPODA, TESTACEA									
Euglypha sp.	×								
CILIATA									
Cyclidium citrullus Cohn							×	×	
undetermined forms	×	×	×		×	×			×
ROTATORIA, BDELLOIDEA									
Philodina acuticornis odiosa Milne			×		×	×			
Habrotrocha constricta Dujardin — *elusa vegeta* Milne-group			×						

TABLE 2

Food sources of the forms observed

	according to own observations	according to literature
RHIZOPODA, AMOEBINA		
Vahlkampfia, limax-type	*Chlamydomonas*	
Vahlkampfia, guttula-type	*Nostoc*	
Naegleria soli	*Nostoc*	
Naegleria bistadialis		
Trichamoeba sp.		
Mayorella vespertilio	*Chlamydomonas, Nostoc*	diatoms, green algae (Mackinnon & Hawes 1961)
Dactylosphaerium sp.	blue-green algae	
Vexillifera ambulacralis		flagellates (Penard 1902)
Astramoeba stella		
Astramoeba sp.		
Thecamoeba striata	*Nostoc*	
Thecamoeba sp.	blue-green algae	
Nuclearia sp.		
RHIZOPODA, TESTACEA		
Euglypha sp.		diverse algae (Grospietsch 1965)
CILIATA		
Cyclidium citrullus		bacteria (Kahl 1931)
ROTATORIA, BDELLOIDEA		
Philodina acuticornis		diatoms (Donner 1965)
Habrotrocha sp.		detritus (Lucks 1929)
NEMATODA		
Acrobeloides nanus		bacteria (Sohlenius 1972)

TABLE 3

Microfauna observed in Maguire's traps

Trap number	1	2	3
RHIZOPODA, HELIOZOA			
Actinophrys sol Ehrbg	×	..	..
ROTATORIA, MONOGONONTA			
Euchlanis dilatata Ehrbg	..	×	..
Cephalodella gibba (Ehrbg)	×	..	..
Cephalodella gracilis (Ehrbg)	..	..	×

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