

The status of the land-arthropod fauna on Surtsey, Iceland, in summer 1981

By

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INTRODUCTION

Since the volcanic island Surtsey emerged from the sea the dispersal of organisms to the island and the development of biotic communities there have been studied by a number of biologists.

Lindroth et al. (1973) gave a full report of the land-arthropod fauna on Surtsey up to 1970. This was followed by Ólafsson (1978) reporting on the situation during 1971-1976, and by Bødvarsson (1982), dealing with Collembola on Surtsey from the beginning of research on the island up to 1978.

Since 1976 the present author has not had the opportunity to visit Surtsey until in July 1981. This is a report on the status of the land-arthropod fauna on the island as distinguished during that visit, with notes on the principal changes which have occurred since 1976.

In Ólafsson (1978) some of the Hymenoptera from 1971, 1972 and 1974 were excluded as they had not been identified. They have been included in the present paper.

THE FIELD-WORK

In 1981 field-work took place on July 10-16. The weather was generally unsettled. Only on July 10 the weather was favourable for collecting flying insects, warm south-easterly gentle breeze and sunshine. The remaining days the wind was fresher, sometimes too strong for field-work, mostly rainy but sandstorms when dry. These days were used for collecting in caves and searching for life under driftwood.

Thirteen pit-fall traps, made of petri-discs with a formaldehyde solution and soap, were stationed on the northern spit and on the north-

eastern part of the lava-field, 10 and 3 in each locality, respectively. Because of the generally adverse weather they were operated for 64 hours only from July 13 to 15. Moss samples were collected from the lava fields for treatment in Berlese-funnels. Most of them have been sent to Dr. H. Bødvarsson, Uppsala, for further examination.

THE MATERIAL

The material collected in 1981 consists of 1244 specimens of land-arthropods and 2 oligochaetes. Collembola dominate with 723 exx. They will be reported upon later by H. Bødvarsson thus only vaguely referred to in the present paper.

The Collembola that are mentioned, were identified by H. Bødvarsson, the Aphidina by R. Danielsson, Lund, and the Araneae by Árni Einarsson, Reykjavík. The remaining material was identified by the author.

THE SPECIES LIST

The number of specimens of each species collected in 1981 is given in brackets after each species name. Species not previously recorded from Surtsey are marked with an asterisk. All Collembola are excluded.

HEMIPTERA

Aphidina

**Acyrtosiphon auctus* Walk. (33).

LEPIDOPTERA

Fam. Yponomeutidae

Plutella maculipennis Curt. (4).

COLEOPTERA

Fam. Carabidae

Amara quenseli Schnh. (1).

Fam. Staphylinidae

Atheta atramentaria Gyll. (3).

**A. excellens* Kr. (1).

A. sp. (2 larvae).

DIPTERA

Fam. Chironomidae

Cricotopus variabilis Staeg. (8).

Orthoclaadiinae indet. (1).

Diamesa bertrami Edw. (1).

D. zernyi Edw./*bohemani* Gtgh. (7).

Fam. Ceratopogonidae

Gen. sp. (1).

Fam. Phoridae

Megaselia sordida Zett. (1).

Fam. Piophilidae

Piophila vulgaris Fall. (7).

Fam. Coelopidae

Coelopa frigida F. (9).

Fam. Heleomyzidae

Heleomyza borealis Boh. (81).

Fam. Ephydriidae

Philygria vittipennis Zett. (4).

Fam. Sphaeroceridae

**Limosina rufilabris* Stenh. (1).

Fam. Drosophilidae

Drosophila funebris F. (1).

Fam. Carnidae

**Meoneura lamellata* Coll. (52).

Fam. Scatophagidae

Scatophaga furcata Say (1).

Chaetosa punctipes Meig. (1).

Fam. Muscidae

Musca domestica L. (2).

Hydrotaea dentipes F. (2).

Myospila mediatubunda F. (1).

**Limnophora orbitalis* Stein (1).

Fam. Anthomyiidae

Fucellia fucorum Fall. (7).

Hydrophoria teate Walk. (1).

Pegohylemyia fugax Meig. (2).

Nupedia infirma Meig. (7).

Delia platura Meig. (3).

Delia sp. (*platura* Meig./*echinata* Ség.) (3 ♀).

Fam. Calliphoridae

Protophormia terraenovae R.-D. (2).

Calliphora uralensis Vill. (2).

Cynomyia mortuorum L. (1).

Indet. larva (1).

Cyclorrhapha

Indet. larvae (6).

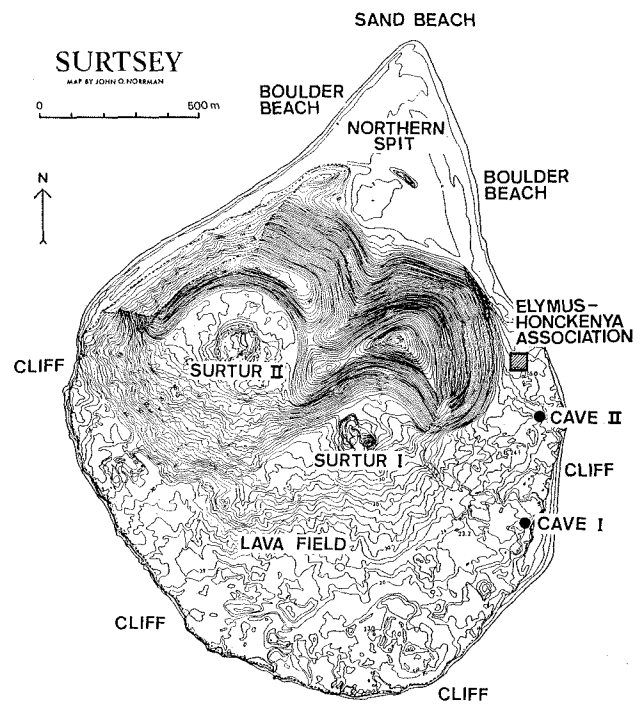


Fig. 1. Topographic map of Surtsey, based on air photographs of 11 July, 1975. Adapted from Norrman (1978).

ARANEAE

Fam. Linyphiidae

Erigone arctica White (43).

Cf. *Erigone* sp. (9 juv.).

Meioneta nigripes Simon (1).

Lepthyphantes mengei Kulcz. (2).

L. cf. mengei Kulcz. (3 juv.).

ACARI

Neomolgus sp. (71).

Indet. spp. (131).

OLIGOCHAETA

Fam. Enchytraeidae

Gen. sp(p.) (2).

BIOTOPES AND COMMUNITIES

In the following discussion the development of some biotopes and their faunas will be outlined. For the location of the different biotopes see Fig. 1.

It is obvious that some of the species listed above have found a suitable habitat on Surtsey and have settled permanently on the island. As shown by Bødvarsson (1982) the island may sometimes be rather inhospitable to some of the smaller organisms. For instance certain species of Collembola were quite common in 1976 but missing in 1978, presumably because of exceptionally dry weather that year. Nonetheless some

other species have obviously settled on the island for good, viz. some species of collemboles (see Bødvarsson 1982) and acarids, a single aphid species, some species of Diptera, some spiders, and perhaps also one or two staphylinid beetles.

Carcasses

The first opportunities insects were offered to survive and multiply on the island were probably connected with carcasses drifted ashore and birds dying on the island. A certain amount of competition for carcasses is likely to occur between gulls and the saprophagous insects. In 1981 a number of carcasses were found that had been covered by tephra, thus inaccessible to gulls. These were inhabited by *Heleomyza borealis* larvae, a species that proved to be very common on the island in 1981.

The shores

The shores of Surtsey offer three main kinds of conditions, all of them being rather inhospitable.

The tip of the island's northern spit is formed of a very unstable sandy beach, constantly moving depending on the wind direction and force. In a few hours only the sand spit may totally alter the form. This of course means that a firm fauna has difficulty in establishing itself on this beach. Yet the collembole species *Archisotoma besselsi* Pack. is usually to be found there. No doubt this halobiontic species is simply moved along with the sand, as it is often observed floating on the surface of the sea. Many other species of Collembola have been found on the shore (see Bødvarsson 1982), but *A. besselsi* seems to be the only one never missing, being found under drifted seaweed and other drifted objects, as well as unprotected on the open sand. One life macropterous specimen of the carabid beetle *Amara quenseli* was found under a small piece of wood on this beach.

The extreme tip excluded, the shores of the northern spit are built up by boulders of varying size. These boulders are frequently moved by heavy surf so most algal vegetation is excluded from this beach, which thus looks quite sterile. Only one land-arthropod species was found here, viz. the predatory mite *Neomolgus* sp., which was surprisingly common. A predator must have a prey. These may have been collemboles that were not detected, although cannibalism may also occur.

The third shore type is found under the high cliffs on the east, south and west side of the is-

land. These shores are much more stable, compared with the northern spit, but are nonetheless drastically altered during winter storms. During the summer drastic changes only take place when the surf is exceptionally heavy. These semi-permanent rocks manage to get covered by green algae during the summer time. As on the boulder beach the mite *Neomolgus* sp. was common on these coasts. The salt water rockpools were not studied this time, but they are known to provide niche for the chironomid *Cricotopus variabilis* and the collemboles *Archisotoma besselsi* and *Isotoma maritima* Tullb. (Lindroth et al. 1973; Ólafsson 1978).

The inner parts of the northern spit

This area can be described as a sandy plain with boulders buried to greater or lesser extent in the sand. Occasionally the sea flows over this plain, especially in winter, forming a line of driftwood and variety of debris below the slopes. Scattered plants of *Honkenya peploides* (L.) Ehrh. grow in this area, some of them infested by the aphid *Acyrtosiphon auctus*. On the humid underside of the driftwood fungi grow. This habitat developed early in the history of Surtsey and soon attracted several species of collemboles and acarids, even spiders and enchytraeids. This habitat and its fauna has scarcely changed the last years. Bødvarsson (1982) gives further information on this area.

The lava-field

In the lava the vegetation has made great progress compared with the situation in 1976 (see Fridriksson 1978). The moss cover is increasing steadily, especially in the Surtur II crater and in the lava flow from Surtur I. In some areas, for instance the Surtur I crater, where mosses were well developed in previous years, by 1981 the vegetation had been mostly covered by tephra and thus destroyed. As outlined by Bødvarsson (1982) the moss was inhabited by a variety of soil animals in 1976. This fauna appears to have been destroyed by the drought of summer 1978. In 1981 a poor soil fauna had been reestablished. Moss samples were collected for treatment in Berlese-funnels. They were all sent to H. Bødvarsson for study and are not dealt with further in this paper except details of a few samples retained by the author. Acarids were found in all of them and two species of Collembola in one of the samples, viz. *Onychiurus duplopunctatus* Strenzke and *Smint-hurides malmgreni* Tullb., the latter species new to Surtsey.

Most land-arthropods seemed to be confined to well sheltered damp places like collapsed caves. Only acarids were found in the more exposed places. A certain collapsed cave on the south-east part of the island was studied thoroughly (cave I, Fig. 1). The moss flora is well developed in this cave. *Onychiurus duplopunctatus* (4 exx.) and *Sminthurides malmgreni* (13 exx.) were extracted from a moss sample collected there and two juvenile spiders (cf. *Erigone* sp.) as well. Six additional specimens of spiders were collected here, *Erigone arctica* (ad. ♀), cf. *Erigone* sp. (1 juv.), *Lepthyphantes mengei* (ad. ♀ with egg cocoon) and *L.* cf. *mengei* (3 juv.). In another cave (cave II, Fig. 1), which had only a small opening in the ceiling four spiders were collected on a big stone below the opening. *Erigone arctica* (ad. ♂), cf. *Erigone* sp. (2 juv.) and *Meioneta nigripes* (ad. ♂). Some acarids were found there as well. In 1976 2 specimens of *E. arctica* were collected on exactly the same spot (Ólafsson 1978). The silky threads of spiders were commonly observed on the lava.

The north-eastern part of the lava-field has been partly covered by tephra. In that area a simple plant community has developed, composed of a few plant species. The most important species is *Honkenya peploides*, which has been the most prominent species on Surtsey since early in the history of the island (Fridriksson 1970, 1978). In last years the species has increased explosively, represented by thousands of individuals in 1981, distributed all over the island.

A subsection of this area was studied specifically. There were two well developed *Elymus arenarius* L. tufts, covering about 2 m² each, a few plants of *Mertensia maritima* (L.) S.F. Gray and *Cochlearia officinalis* L., also undeveloped grasses, probably *Festuca rubra* L., growing among the *Honkenya* plants.

Obviously only few species of arthropods feed solely on this vegetation. The aphid *Acyrtosiphon auctus* turned out to be abundant on some of the *Honkenya* plants, both winged and apterous individuals. In the larger *Honkenya* tufts, some of which may cover 1 m² or more, branches were rotting and covered by fungi. There the collembole *Hypogastrura denticulata* Bagn. was found to be common.

Bird nests

A pair of Great Black-backed Gulls *Larus marinus* L. nested on the island for the first time in 1974. Ever since a few pairs have nested there

annually. The gulls were suspected to have negative influence on the development of plant succession by tearing up plants for use as nest material. It has now become obvious, that the gulls have proved to be very important components in the simple life community now established on Surtsey. In 1981 five pairs of Great Black-backed Gulls were found to have produced young on the island. Also a pair of Herring/Glaucous Gull hybrids *Larus argentatus* Pont. / *hyperboreus* Gunn. (cf. Ingólfsson 1970). Their nest was located in a small collapsed cave. A single young was found nearby. The nest was built primarily of *Racomitrium* moss. Nest materials were collected and treated in Berlese-funnels, but only a single acarid was found.

One of the nests of the Black-backed Gulls was located on one of the *Elymus* tufts. The other nests were not found as the young had left well before this field-work took place. The nest materials consisted of branches and leaves of *Elymus* and *Honkenya*. The nest was mostly covered by tephra under which the nest materials were decaying. Here Diptera larvae abounded. The majority of them belonged to the species *Heleomyza borealis*, a single larva of the family Calliphoridae was also found and larvae of two or three other unidentified species. Two staphylinid species were also found in the nest, *Atheta atramentaria* (3 exx.) and *A. excellens* (1 ex.), the latter being new to the island. Two *Atheta* sp. larvae were extracted from nest materials treated in Berlese-funnels, also the collembole *Hypogastrura denticulata* (9 exx.) and acarids (12 exx.).

Obviously the importance of the gulls was not just confined to the nest. The gulls or their young seek shelter in the *Elymus* tufts leaving droppings and food remains behind, enriching the soil. Of course this benefits the plants, also giving saprophagous and coprophagous Diptera species like *Piophilula vulgaris* and *Meoneura lamellata* excellent opportunities. The latter, which was known to be rare in Iceland, (Andersson 1967; Lindroth et al. 1973) proved to be surprisingly common in these droppings. The species had not been observed on Surtsey before. Of course a community needs predators for its completion. The spider *Erigone arctica* was found to be common in that community, 41 ad. were collected and 3 juv. cf. *Erigone* sp., also a single *Lepthyphantes mengei* (ad. ♀).

To summarize, a simple but apparently self-sufficient ecosystem has now been established on Surtsey, composed of a few species of vascular

plants, fungi, various invertebrates with different demands, birds, and no doubt different microorganisms, (which are beyond the scope of this study). This ecosystem is of course simple and probably unstable, but it is obviously the beginning of a more complicated ecosystem to be developed in the future.

NOTES ON OLDER HYMENOPTERA MATERIAL

When preparing my previous publication on the land-arthropods of Surtsey (Ólafsson 1978) some specimens of Hymenoptera had not been identified. These specimens have now been studied by specialists in the field. The 6 specimens in question belong to 5 species:

Fam. Braconidae

Meteorus rubens Nees (*leviventris* Wesm.) 11.VIII.1971, 2 exx., leg. E. Ólafsson (det. T. Huddleston).

Fam. Ichneumonidae

**Pimpla instigator* F. 1.VII.1971, 1 ex., leg. E. Ólafsson (det. G. J. Kerrich).

**Promethes pulchellus* Hlgr. 22.VIII.1972, 1 ex., leg. J. Eldon (det. G. J. Kerrich).

Meloboris collector Thunb. 3.VIII.1974, 1 ex., leg. E. Ólafsson (det. R. Hinz).

**Diadegma boreale* Horstm. 10.VIII.1972, 1 ex., leg. J. Eldon. HOLOTYPUS (see Horstmann 1980).

Of these 5 species 3 are new to Surtsey, 2 are new to the Icelandic fauna, viz. *P. instigator* and *D. boreale*, and the last mentioned turned out to be new to science, described by Horstmann (1980).

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