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THE SPIDERS OF BEAR ISLAND

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The Spiders of Bear Island.

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Bear Island lies between and at a distance of some two hundred miles from Spitsbergen and Norway.

In 1871 Dr. T. THORELL recorded one spider, *Coryphoeus holmgreni* THOR. from Bear Island. The same species was recorded by Prof. E. STRAND in 1911 and Dr. A. R. JACKSON in 1922.

Two more recent collections have been made, by Dr. SIG THOR in 1928 and by Mr. DAVID LACK together with Mr. G. C. L. BERTRAM of the Zoological Laboratory, Cambridge, in 1932 [1]. The present paper concerns these two collections.

Dr. SIG THOR'S collection was examined by Prof. C. FR. ROEWER, and a note appeared in 1930 which analysed it as follows:

Hilaira glacialis THOR. 41 specimens (both sexes represented).
Erigone arctica WHITE. 6 specimens (no males).

The second collection, kindly sent me for examination by Mr. D. LACK, comprised the following:

Coryphoeus holmgreni THOR. . . . 289 ♀♀, 50 ♂♂ 111 young.
Erigone tirolensis L. KOCH. . . . . 10 ♀♀, 0 ♂♂.

It seemed to me surprising that *Coryphoeus holmgreni* should not have been included in Dr. SIG THOR'S collection and still more strange than Mr. LACK and Mr. BERTRAM should not have had either of Dr. THOR'S species in their extensive collection amassed at the same time of year from all parts of the island. It seemed to me likely that some confusion of species had occurred, so I wrote to the Zoologisk Museum in Oslo, where Dr. THOR'S collection was housed, and they have very kindly sent me his specimens. My doubts were justified, for I find that his collection comprises the same two species as those found by Mr. LACK and Mr. BERTRAM. Thus the spider fauna of Bear Island consists of *Coryphoeus holmgreni* THOR. and *Erigone tirolensis* L. K., and it seems certain that these two species are the only two living there today. To avoid further confusion I give drawings of the sexual organs.

The females of the genus *Erigone* are very difficult to distinguish, but there are slight differences in the vulvae of

[1] A general account of this expedition is appearing in the 1933 Geographical Journal.

E. tirolensis and *E. arctica*, most evident when the species are placed side by side, which, taken in conjunction with the larger size of the latter and a tendency to have larger teeth on the exterior of the chelicerae, serve to make their differentiation certain.

Both these species have been found on Jan Mayen and Spitsbergen (as well as in other localities). My collection on Jan Mayen in 1921 comprised approximately 300 specimens, of which about 200 were assignable to *Coryphoeus holmgreni* and 8 to *Erigone tirolensis*[1]. Thus, though Jan Mayen has a larger fauua, it resembles Bear Island in having *Coryphoeus holmgreni* as the dominant species. On Spitsbergen things are different. *Corphoeus holmgreni* has been recorded by Prof. STRAND in 1911, by Dr. JACKSON in 1925, and it is included in Dr. THOR'S collection in Spitsbergen, but it is scarce and the dominant species are *Erigone psychrophila* THOR., *Typhochrestus spetsbergensis* THOR. and *Leptyphantes sobrius* THOR. Thus, out of 222 adult spiders collected by Mr. C. S. ELTON in 1921, 1923 and 1925, 69 belonged to *Erigone psychrophila*, 63 to *Typhochrestus spetsbergensis*, and 42 to *Leptyphantes sobrius*[2]. Thirteen species are now known from Spitsbergen, but this list does not include *Hilaira frigida* THOR., which is abundant on Jan Mayen.

Whether the scarcity of *Coryphoeus holmgreni* on Spitsbergen is due to competition or to climatic differences is difficult to say, but it is noteworthy that there is less fog on much of Spitsbergen as well as a shorter summer and lower temperatures. This species has also been found in Siberia, Nova Zemlya, Norway, the Faeroes and Great Britain. Other localities for *Erigone tirolensis* include Siberia, Nova Zemlya, Iceland, Great Britain. Switzerland and the Tyrol.

Owing to the shortness of the Arctic Summer it is interesting to speculate as to the stage or stages at which they pass through the severe winter[3].

The sun remains below the horizon from November 7th to February 4th and permanently above the horizon from April 30th to August 13th. In 1932 the summer was late in arriving and

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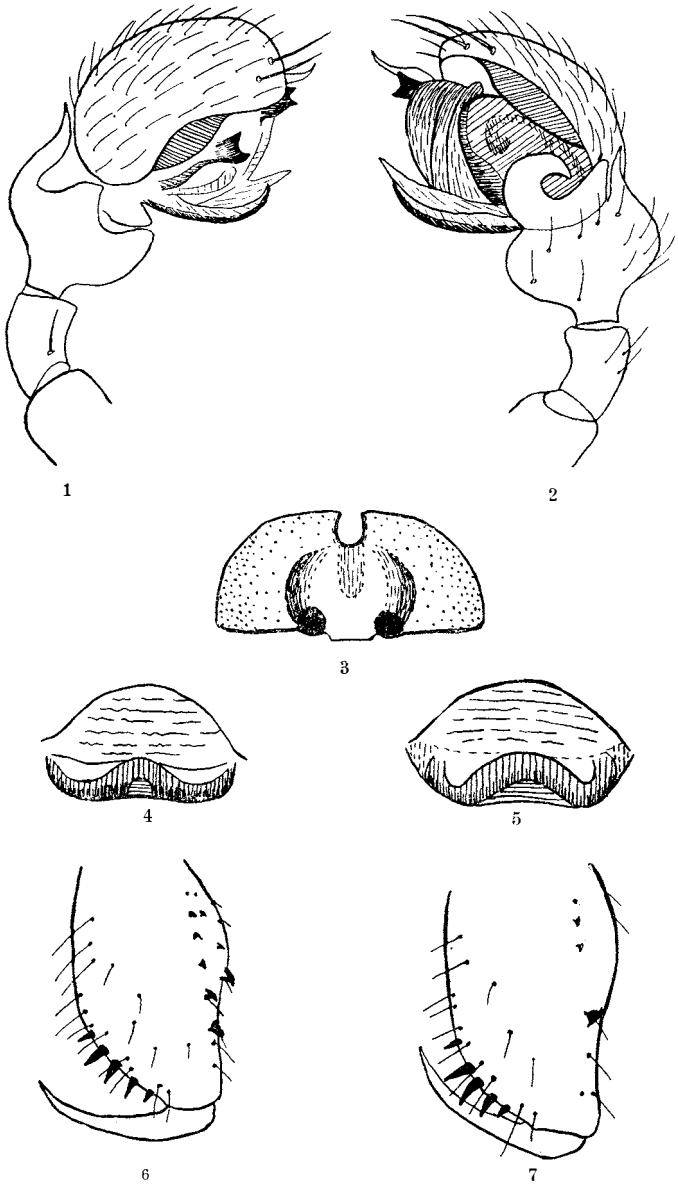
[1] The other species were *Hilaira frigida* THOR. in abundance, *Micryphantes nigripes* SIM. scarce, and one specimen of an immature *Microneta*. *Ann. Mag. N. H.* Ser. 9, Vol. XV, p. 480, 1925.

[2] Dr. A. R. JACKSON, Ann. Mag. N. H. Ser. 9, Vol. IX, p. 163, 1922; Vol. XIII, p. 77 1924; Vol. XV, p. 536, 1925.

[3] I am greatly indebted to Mr. LACK for information about the island and an account of his careful observations on which I have drawn in the preparation of the present paper.



Figs. 1, 2. *Coryphoeus holmgreni* THOR. Male palpal organs.
Fig. 3. *Coryphoeus holmgreni* THOR. Female vulva.
Figs. 4, 6. *Erigone tirolensis* L. K. Female vulva and chelicera.
Figs. 5, 7. *Erigone arctica* WHITE. Female vulva and chelicera.

the snow did not begin to melt until June 10th, ten days before the arrival of the expedition. Eggs, young and adults were all found within a few days of the commencement of summer, so it seems certain that *Coryphoeus holmgreni*, at least, can pass the winter at any stage in its existence. The following analysis, however, suggests that the main mating season is in July and the main egg-laying period towards the end of the season:

Month	*Coryphoeus holmgreni*		
	Female	Male	Young
June	53.2 %	9.7 %	37.1 %
July.....	57.6 »	14.6 »	27.8 »
August	75.4 »	7.7 »	16.9 »

I noted a similar falling off in the number of young spiders towards the end of the season on Jan Mayen, and then, towards the close of summer at the end of August, a large number of dead adults. This led me to believe that maturity is probably reached in one year, but Mr. LACK'S collecting in the early summer satisfies me that I was incorrect in supposing that winter was passed solely in the egg stage.

Spiders were abundant on Bear Island, as they are on Jan Mayen and in other parts of the Arctic, but they were for the most part restricted to the underside of boulders and stones which were situated among vegetation on one or two steep slopes. Under these boulders there were usually three or four spiders, but under those away from these slopes there was only one to about every twenty boulders. The spiders did not occur in the vegetation itself nor on the bird cliffs where certain insects abounded (Muscids, Collembola, Staphylinids). I have noticed a similar scarcity of spiders on cliffs frequented by Guillemots round the British coast and have called attention to their apparent distaste for areas frequented by Puffins [1].

Food appears to consist of small Chironomid flies and Collembola and they were seen eating these both in the field and in captivity. The only moth, *Plutella maculipennis*, is too large, as are several of the other insects, mites are distasteful, and the five beetles are probably too formidable. In two cases *Olophrum boreale* PAYK. was seen devouring *Coryphoeus holmgreni*.

In writing about Jan Mayen (loc. cit) I suggested that the driftwood which is so abundant on its shores might have contributed largely towards its colonization by arthropods, but later

[1] Proc. Zool. Soc. Pt. 2, 1929, p. 236: Pt. 1, 1931, p. 19.

investigation of island faunas leads me to believe that oceanic islands derive their fauna mainly from air-born arthropods.

Mons. L. BERLAND, who has also studied the spider fauna of islands[1], does not agree with me, but the more I study the subject the stronger my conviction becomes. I have dealt with the subject at length elsewhere[2], but a few observations may not be out of place. It seemed to me that there were two means, both somewhat fantastic, of testing arthropods' powers of dispersal, (1) sweeping the air with nets from aeroplanes, and (2) the formation of an artificial island out to sea which would be kept under close observation. The former would show the types of arthropod which could reach appreciable heights and which, in consequence, could probably be carried considerable distances across the sea; the latter would demonstrate that certain arthropods could cross the sea, though it would not necessarily demonstrate by what means they had suceeded in doing so. In 1928 I tentatively approached the British Air Ministry to see if they would assist me in my endeavour to collect arthropods at high altitudes, but the idea did not receive their encouragement, though they informed me that aeroplanes frequently ran into masses of gossamer. Shortly afterwards I learned that botanists at Cambridge had collected fungal spores at considerable heights by exposing gummy slides to the air, but no result came of my effords to persuade them to use nets or boxes. Collecting in the manner I had envisaged has now been carried out in America with very interesting results[3]. Collections were made at heights of from 50 to 14,000 ft. and it was found that the number of arthropods showed a progressive decrease as higher elevations were reached. The density varied at different times of the year, but it was calculated that, on the average, there were no less than 25,000,000 arthropods above 50 ft. from the ground in a column of air with a base area of one square mile. Spiders and mites were collected at 14,000 ft. and it was noted that strong flying insects were more abundant at lower altitudes, whilst weak flying kinds, or forms with no wings at all, were more numerous at the higher levels. "Air currents at the higher altitudes frequently become extremely swift as compared with winds normally experienced on the ground, and it is easy for insects reaching such currents to be carried forward on them hundreds of miles within a comparatively short time . . . . .".

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[1] Compte Rendu Somm. Séances Soc. Biog. No. 23, 1926.
[2] Proc. Zool. Soc. Pt. 4, p. 633, 1930: Soc. de Biogéographie, p. 45, 1930.
[3] R. C. Coad. Yearbook of Agriculture (Publd. by U. S. Dept. of Agric.) 1931, p. 320.

Passing to the second scheme, the formation of an artificial island, this does not seem quite so fantastic when we review the recent land reclamation accomplishments in Holland, or consider the schemes, which may materialise some day, for the installation of floating islands to make it possible for aircraft to land in mid-ocean. Alternatively, it might be possible to find a minute isolated island somewhere whose fauna and flora could be investigated carefully, then demolished completely by chemical means. This would afford naturalists an opportunity of studying its recolonization. The Krakatoa eruption of 1883 accomplished this result by natural means, but owing to its relative inaccessibility zoologists were not able to take full advantage of the opportunity offered them. In 1929 renewed volcanic activity in the same area resulted in a small new island being heaved up from the sea bottom, but this is not entirely ideal for study on account of its being separated from the other islands of the group by so small a distance as three miles. When I visited it two years after its formation there was no soil in which the seeds I found on it could prosper, but arthropods included a Collembolan and a beetle in great abundance, three species of spider, a small moth, two species of ant and a mosquito[1].

Reverting to Bear Island, it has certainly not been connected with any mainland for a very long period. We are probably safe in regarding its present fauna as having been introduced comparatively recently and, as I have said above, I believe that the majority at least have managed to cross the sea by air. It is interesting to note that on a particularly "hot" day in early August, when the temperature was about 8° C.[2], a spider was seen on Bear Island running over plants, for in the ordinary course of events they were never found amongst the vegetation except under stones, and when Linyphiids are to be seen running in the open they are usually about to embark on an aerial expedition.

Bear Island references.

1871. T. Thorell. Øfversigt Vetensk.-Akad. Förhandl.
1911. E. Strand. Avifauna Spitzbergensis. A. Koenig.
1922. A. R. Jackson. Ann. Mag. N. H. Ser. 9, Vol. IX, p. 163.
1930. C. Fr. Roewer. Skrifter om Svalbard og Ishavet No. 27

[1] Proc. Zool. Soc. Pt. 4, 1931, p. 1387.

[2] The average monthly temperatures are as follows: Jan. —9.4° C., Feb. —11.2° C., March — 11° C., April —7.6° C., May —2.3° C., June 1.7° C, July 4.2° C., Aug. 3.6° C., Sept. 1.9° C., Oct. —1.7° C., Nov. —6.3° C., Dec. —7.5° C.

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