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1907b Arctic Tardigrada, collected by William S. Bruce.

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ARCTIC TARDIGRADA, COLLECTED BY WM. S. BRUCE.

BY

JAMES MURRAY.

[With Two Plates.]

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XXV.—Arctic Tardigrada, collected by Wm. S. Bruce. By James Murray. *Communicated by* William S. Bruce. (With Two Plates.)

(MS. received January 11, 1907. Read February 21, 1907. Issued separately July 6, 1907.)

These notes on Arctic Tardigrada embody the results of an examination of quantities of moss collected by Mr William S. Bruce on his various expeditions to the Arctic Regions.

While studying the Tardigrada of the Scottish lochs, I wished to compare our Tardigrade fauna with that of more northern lands, as it was thought that, considering the geographical position of Scotland, its fauna might have some relation with that of those lands. Mr Bruce was kind enough to put all his available material at my disposal.

The various expeditions to the North in which Mr Bruce took part cover a period of ten years, from 1896 to 1906. They are:—The Jackson-Harmsworth Polar Expedition, 1896 and 1897; Mr Andrew Coats' Expedition to Novaya Zemlya, Wiche Islands, and Barent's Sea, 1898; H.S.H. The Prince of Monaco's Expedition, Spitsbergen and North Polar Regions, 1898; H.S.H. The Prince of Monaco's Expedition, Spitsbergen and North Polar Regions, 1899; H.S.H. The Prince of Monaco's Expedition, Spitsbergen, 1906.

The material collected on the earlier expeditions was all preserved in spirit, and its use was limited to the identification of adult examples. The moss collected in the 1906 expedition was of especial value, as, by previous arrangement with Mr Bruce, the collections were made with a view to the study of the microfauna. Mr Bruce collected the moss just before departing for the South at the end of August, and I was thus enabled to examine it in the fresh condition within a month afterwards. In this way I could study the animals when alive, by which the structures of the various organs can be better made out than in contracted specimens. The chief advantage of having the fresh moss was, however, that the young could be watched issuing from the eggs, and thus the identity of certain eggs with the adult animals established.

There is no part of the world the Tardigrada of which have received so much attention as Spitsbergen, except Germany. The other parts of the Arctic Regions visited by Mr Bruce appear to be virgin soil as regards the study of the Tardigrada, except Bear Island, from which 1 species, *M. ornatus*, was known.

The collections examined were from Bear Island, Spitsbergen, Franz Josef Land, Novaya Zemlya, and Kolquev, and in all but the last named some Tardigrada were obtained. Very few species were found in Bear Island and Novaya Zemlya, but the

collections from Spitsbergen and Franz Josef Land were very rich, and included many species not previously recorded from the Arctic Regions, and several new to science.

The anticipation that the Tardigrade fauna of Scotland would show some distinct relation to that of the Arctic Regions was borne out by the results of our comparative studies. It was already known that in the Crustacea of the plankton of the Scottish lochs there was a very conspicuous Arctic element. As the Tardigrada are not swimmers in open waters, however, the conditions governing their distribution are probably quite different from those affecting the plankton Crustacea.

Even on the mainland of Scotland there were several species of Tardigrada only previously known in the Arctic Regions, such as *Echiniscus spitsbergensis*, *E. wendti*, *E. oihonnæ*, *Macrobiotus echinogenitus*; but it was only when the Shetland Islands were visited that we learned how extensive was the correspondence between Scotland and the most northern lands known.

Including several species which were discovered in Shetland, there are now 14 species known which are common to Scotland and one part or other of the Arctic Regions and are unknown elsewhere.

No doubt, when the Tardigrada of other countries are better known, it will be found that many of those species are not restricted to northern lands. Already it is known that *M. echinogenitus* has an almost world-wide range, and *E. mutabilis* also ranges far in more southern lands; but in the present state of our knowledge the close correspondence between Scotland, Spitsbergen, and Franz Josef Land is remarkable.

In all Mr BRUCE's collections 28 species of Tardigrada were identified and 4 others were studied. Three new species and two new varieties are here described.

SPITSBERGEN.

Previous to the publication of SCOURFIELD's short list of Tardigrada in 1897 (15), the only record of a Spitsbergen Tardigrade is that of GOËS, who in 1862 recorded a species of *Macrobiotus* somewhat doubtfully as *M. dujardinii*, DOY.

SCOURFIELD found 6 species in moss collected by Dr J. W. GREGORY during Sir W. Martin Conway's Expedition in 1896 (15). There were 3 known species:—*Echiniscus arctomys*, EHR., *Macrobiotus hufelandii*, C. A. S. SCHULTZE, and *M. tuberculatus*, PLATE; 1 new species, *E. spitsbergensis*; and 2 which were not identified. One of these, according to SCOURFIELD's notes, would appear to have some resemblance to *M. sattleri* and *M. papillifer*; the other, with narrow pharynx, is doubtless a *Diphascon*, very probably *D. spitsbergense*, RICHTERS.

SCHAUDINN (13) in 1901 describes 1 new species, *E. spiculifer*.

RICHTERS, who examined moss collected on Wendt's Expedition, published in 1903 a preliminary list (11) and in 1904 a fuller list (12) comprising 16 species, most of which were previously unknown in Spitsbergen and 7 were new to science.

With these additions there were, according to RICHTERS' summary in *Fauna Arctica* (12), 19 species of Tardigrada recorded for Spitsbergen.

In Mr BRUCE's collections I have found 22 species. As 12 of these have not been previously recorded for Spitsbergen, the list of species now numbers 31. Two of the species are new to science, and 7 are species recently discovered in Scotland.

A curious feature in all Mr BRUCE's collections from Spitsbergen is the scarcity of animals of the genus *Echiniscus* and the abundance of species of *Macrobiotus*. Only 2 species of *Echiniscus* were found, and 15 of *Macrobiotus*. This is the more remarkable as there were already 6 species recorded for Spitsbergen, and in Mr BRUCE's collections from Franz Josef Land there were also 6 species of *Echiniscus*. There were 5 species of *Diphascon* observed.

LIST OF SPITSBERGEN SPECIES (BRUCE COLLECTION).

	Prince Charles Foreland.	Recherche Bay.	Red Bay.
Echiniscus arctomys, Ehr.			×
E. mutabilis, Murray	×		
Macrobiotus oberhäuseri, Doy.	×		
M. zetlandicus, Murray	×		
M. ornatus, Richters			×
M. tuberculatus, Plate	×		
M. tetradactylus, Greeff	×		
M. hufelandii, C. Sch.	×	×	
M. intermedius, Plate	×		
M. echinogenitus, Richters	×		
var. *areolatus*, var. nov.			×
M. dispar, Murray	×		
M. ambiguus, Murray	×		
M. crenulatus, Richters	×		
M. harmsworthi, sp. n.	×		
M. arcticus, sp. n.	×		
M. islandicus, Richters?	×	×	
M. pullari, Murray	×		
Diphascon chilenense, Plate	×		
D. alpinum, Murray	×		
D. spitsbergense, Richters	×		
D. scoticum, Murray	×	×	
D. angustatum, Murray		×	

FRANZ JOSEF LAND.

The collections from Franz Josef Land were more numerous than those from the other Arctic lands visited by Mr BRUCE, and represented a greater variety of situation, from ponds nearly at sea-level to moss growing on an old walrus skull found on a raised beach some 400 feet above sea-level.

Tardigrada were abundant in those collections, and the number of species found (19) was nearly as great as in Spitsbergen. There were besides 2 yet undescribed species.

As compared with Spitsbergen, the various genera were represented in very different proportions. There were 6 species of *Echiniscus*, 10 of *Macrobiotus*, and 3 of *Diphascon*.

The Tardigrada of Franz Josef Land and Spitsbergen do not differ materially: 15 species are known to be common to the two groups, leaving 16 which are known in Spitsbergen and not in Franz Josef Land, and 4 which are known in Franz Josef Land and not in Spitsbergen.

As all the Tardigrada of Franz Josef Land, except only *Echiniscus borealis*, are already known from some other countries, we may expect to find a still closer correspondence between Spitsbergen and Franz Josef Land when the fauna of the latter shall become better known.

LIST OF FRANZ JOSEF LAND SPECIES (BRUCE COLLECTIONS).

	Carpenter's Rock.	Cape Mary Harmsworth.	Cape Gertrude.	Cape Forbes.	Walrus Skull.	Ponds at Elmwood.
Echiniscus arctomys, Ehr.		×	×			
E. mutabilis, Murray			×			
E. wendti, Richters		×	×			
E. spitsbergensis, Scourfield			×			
var. *spinuloides*, var. nov.			×			
E. borealis, sp. n.		×				
E. muscicola, Plate				×		
Macrobiotus annulatus, Murray	×					×
M. augusti, Murray	×	×				
M. hufelandii, C. Sch.				×		
M. intermedius, Plate	×					
M. echinogenitus, Richters	×	×	×	×		
var. *areolatus*, var. nov.	×	×				
M. dispar, Murray		×			×	
M. ambiguus, Murray	×					
M. crenulatus, Richters			×			
M. harmsworthi, sp. n.		×				
M. arcticus, sp. n.		×				
Diphascon spitsbergense, Richters	×					
D. scoticum, Murray			×			
D. angustatum, Murray	×					

NOVAYA ZEMLYA.

There were only a few collections available from one spot in Novaya Zemlya—Kostin Point. These were not very productive, and only 3 distinct species were recognised.

The 2 species named were *Echiniscus spitsbergensis*, var. *spinuloides*, and *Macrobiotus echinogenitus*. The third was only known from an egg, which had hemispherical processes (Plate I. fig. 4). This egg is like one figured in "Scottish Alpine Tardigrada" (6), Plate III. fig. 10, but the Arctic egg is very much larger than the Scotch one. These eggs answer the description of "raspberry-form" given by DOYÈRE to the eggs of his *M. oberhäuseri*, but no sufficiently developed young has been seen in them.

BEAR ISLAND.

In the single collection taken here the only Tardigrade found was *Macrobiotus annulatus*, MURRAY. The single example seen had the typical skin, claws, and pharynx, but it was not carrying eggs. *M. ornatus*, RICHTERS, is the only other species which I find recorded for Bear Island.

NOTES ON THE SPECIES.

Genus ECHINISCUS.

E. arctomys, EHR. (2).—A widely distributed species, ranging from Franz Josef Land to Kerguelen.

E. mutabilis, MURRAY (4).—The spines on the inner claws were seen in all the examples recorded.

E. wendti, RICHTERS (11).—Examples from Franz Josef Land had the long head seta blunt and slightly expanded at the tip.

E. spitsbergensis, SCOURFIELD (15).—Somewhat variable in the length of the processes, especially of the second dorsal process (on the second paired plates). The most divergent variety is described below. In all the localities where the variety was found the type was also present.

Var. *spinuloides*, var. nov. (Plate II. figs. 8*a* to 8*c*) :—

Distinctive Characters.—There are little sublateral spines on four segments (II., III., IV., and VI.) as in *E. spinulosus*, DOY. (1), and *E. oihonnæ*, RICHTERS (11). The second dorsal process is an elongate curved spine with very broad flat base.

The pattern of the plates consists of large hexagonal marks, which do not appear to stand above the general surface, and enclose each an obscure round mark. There is a blunt palp on the fourth leg. Length, 284μ. Claws, 32μ. Eggs up to five in the cast skin.

Franz Josef Land and Novaya Zemlya. A very similar variety is frequent in Scotland, but the spinules have not been seen. These are, however, often difficult to detect.

Echiniscus borealis, n. sp. (Plate I. fig. 1):—

Specific Characters.—Large (310μ long) plates fourteen, three pairs; first and second median, each divided into two distinct plates; third median, single. Spines numerous: *lateral*, a curved spine on ventral side of head, short curved spines on shoulder plate and first and second pairs, a long seta on lumbar plate; *dorsal* processes, a broad-based spine on the first pair, a similar spine and a small tooth on the second pair, a short broad spine on the third pair; lateral margins of shoulder plate and the three pairs, bearing many small spines, of which those on the third pair are largest. A strong straight spine on outside of fourth leg. Lumbar plate trefoliate. Head seta very long (160μ); palp at base triangular, pointed. No barbs on any claws. Fringe of sharp spines. Plates pellucid, dotted; connecting skin also dotted. Larva two-clawed.

This very distinct species belongs to that section of the genus in which there is a third pair of plates, after the third median plate. Other species having this peculiarity are *E. mutabilis*, MURRAY, *E. conifer*, *E. arctomys*, *E. islandicus*, RICHTERS, and an undescribed species at which Prof. RICHTERS is now working. The only one of these which possesses processes on any plates other than the head plate is *E. islandicus*. The lateral processes are similar in the two species, but the dorsal processes are entirely different, as will be best seen by comparing the figures. *E. islandicus* has, moreover, the plates quite smooth, and possesses rods in the pharynx.

The two-clawed young of *E. borealis* measured 192μ, and all the processes of the adult were present. Skins containing three elliptical eggs were found, the eggs measuring 72μ by 48μ. Franz Josef Land.

The spines on the first and second pairs of plates occupy an unusual position, being near the median line of the body instead of at the angle as usual. The ventral head seta, the little lateral spines, and the straight seta beside the fringe on the last legs are all unusual processes possessed by no other species.

As only skins have been seen, it is unknown whether there are rods in the pharynx, as in *E. islandicus*.

Found only at one station, Cape Mary Harmsworth, Franz Josef Land.

E. muscicola (♀).—This species must be regarded as insufficiently described, as it was not found mature, and several characters necessary to discriminate species are not mentioned. An animal found in Franz Josef Land comes nearest to *E. muscicola*, but the lateral setæ are *a*, *c*, *d*, *e*, instead of *a*, *b*, *c*, *d*. This example was also immature.

Genus MACROBIOTUS.

M. oberhäuseri, DOY. ? (1).—No pigmented examples were found. An animal got in moss from Prince Charles Foreland agreed with this species in characters of pharynx and claws.

M. zetlandicus, MURRAY (8).—This species, recently discovered in Shetland, was abundant also in Spitsbergen. It is easily distinguished from all other known species by the short thick rods in the pharynx, each deeply two-lobed on the outer side.

M. annulatus, MURRAY (4).—Franz Josef Land, in two localities, and Bear Island. Animals typical, but none seen carrying the egg-sac in the manner so characteristic of the species.

M. augusti, MURRAY? (8). (Plate II. figs. 13*a*, 13*b*.)—Previously known only from Fort Augustus in Scotland. The identification is not quite certain, and depends on the three narrow rods in the pharynx, the smooth eggs, and the form of the claws. The middle rod is not decidedly shorter than the others, as in Scotch examples.

Another example, with equally narrow rods and similar claws, had only two rods, and thus resembles the newly hatched young, as found in Scotland.

M. ornatus, RICHTERS (10).—Found only at Red Bay, Spitsbergen, where it was abundant. Some skins with two eggs were found.

M. tuberculatus, PLATE (9).—Very insufficiently described by PLATE, whose figure and text are contradictory. It is likely that there are several tubercled species besides *M. sattleri* and *M. papillifer*, as I have found tubercled animals with different types of pharynx.

An example from Prince Charles Foreland agrees with PLATE's description in having very divergent claws. The tubercles are large and papillose; there are four on each chief segment and on each intermediate segment. The two pairs of claws are similar, and one claw of each pair is longer. The pharynx is shortly oval, with three short rods, increasing in size from first to third, besides a nut attached to the gullet. There are two dark eyes. In size it is larger than other tubercled examples seen, measuring 300μ in length.

M. tetradactylus, GREEFF? (3).—An animal found in Prince Charles Foreland is referred doubtfully to this species.

Macrobiotus, sp.—In Franz Josef Land were found some examples of a species which is common at the margins of Scottish lochs, and which is believed to be an undescribed species. The claws are of the *oberhäuseri* type, and the pharynx has two equal short rods, a nut attached to the gullet, and a "comma." In Scotland the cells forming the walls of the stomach are usually filled with blue granules. In specimens preserved in spirit it is impossible to tell if the blue granules have been present. The eggs are smooth, and are laid in the skin. See figure in "Tardigrada of the Scottish Lochs" (4), Plate III. fig. 12, where it is erroneously named *M. islandicus*. At that time the eggs had not been observed, or the error would have been avoided. An example also occurred in Prince Charles Foreland.

Macrobiotus, sp.—In Franz Josef Land there were found several examples of a *Macrobiotus* which lays elliptical eggs in the cast skin. The eggs had been attacked by a parasite, possibly a kind of *Saprolegnia*. From each egg there proceeded a tube which penetrated the back of the skin of the parent and formed a slight expansion just

outside it (Plate II. fig. 9*a*). The [illegible], but in Scotland the living parasite has been seen [illegible] the body of the Tardigrade.

The species attacked appear to be undescribed. The pharynx (fig. 9*c*) has three rods, of which [illegible] one is shorter. This is a rare arrangement, only known in *M. augusti*, which has [illegible] more slender rods and differs [illegible] other respects. Carpenter's Rock, Franz Josef Land.

M. hufelandii, C. SCH. (14).—A [illegible] supposed to vary considerably, but I expect the most aberrant varieties to prove per[illegible]es, if not species. There is a circlet of radiating lines round the base of each p[illegible] form in Franz Josef Land lacked this circlet. According to RICHTERS, the e[illegible] the simplex form has the processes closer set.

M. intermedius, PLATE (9).—Only found in Franz Josef Land. No eggs were seen, but RICHTERS has observed them in Spitsbergen, and they are occasionally found in Scotland.

M. echinogenitus, RICHTERS (11).—Probably as widely distributed as *M. hufelandii*. The eggs vary greatly. The spines are usually acuminate, and are close together at the bases. They may be short or long, and may be widely separated at the bases. Some other species have very similar eggs, so that it is unsafe to identify from the egg alone, unless it contains a well-developed young.

Var. *areolatus*, var. nov. (Plate II. figs. 14*a* to 14*d*) :—

Distinctive Characters.—Of large size, up to 800μ. Eggs very large, up to 180μ over spines, or 95μ without spines; spines papillose, separated at the bases, the intermediate surface of the shell marked with irregular polygonal spaces, symmetrically arranged. The claws are united for a short distance at the base. The pharynx has three narrow rods, nearly equal, and no comma. Claws of largest examples 40μ long; fat-cells up to 15μ long.

Spitsbergen and Franz Josef Land; also known from mountain tops in Shetland, and the mainland of Scotland, the Himalaya, etc.

After the characters of the egg, the most striking difference is the absence of comma in the pharynx. Many young have been seen to issue from eggs. The teeth are not acicular, but broad and lance-shaped at the ends. Each long claw has two supplementary points.

M. dispar, MURRAY (7).—It is only recently that this species has been distinguished from *M. macronyx*. The rare spiny egg has been seen within a cast skin from Prince Charles Foreland. The dorsal conical processes, which have nowhere been found so largely developed as in Loch Tay in Scotland, were fairly large in a skin found among moss growing on an ancient walrus skull at an elevation of over 400 feet in Franz Josef Land.

M. ambiguus, MURRAY (8).—Another species closely resembling *M. macronyx*, and only recently recognised as distinct. Though very similar to *M. dispar*, it has a very different egg, much larger (diameter over spines 132μ), with larger spines, like those of some forms of *M. echinogenitus*, touching at the bases.

In Prince Charles Foreland adults reached to 800μ long.

M. crenulatus, RICHTERS (12). (Plate I. figs. 6*a* to 6*c*.)—Discovered by RICHTERS [illegible]pitsbergen, this species was observed in Prince Charles Foreland and Franz Josef [illegible] In our examples the last leg was sometimes papillose, as in RICHTERS' *M. g*[illegible]apillose process on the front of each leg, not referred to by RICHTERS. The cresc[illegible]t of the claws is merely wrinkled, not spiny, and the rods in the pharynx are not nearly so thick and strong as in examples of *M. granulatus* which Prof. RICHTERS has kindly sent me.

The colour was dark brown. The largest examples measured 750μ long, the pharynx 66μ long.

M. harmsworthi, sp. n. (Plate I. figs. 7*a* to 7*d*) :—

Specific Characters.—Size moderate, blood pale yellow. Teeth nearly straight, with bearers; pharynx somewhat long, oval; thickenings, four in each row; first, short, attached to the gullet, second, third, and fourth narrow rods, the fourth a little longer than the others. Claws of *hufelandi* type, united half way, one claw of each pair much longer, with two large supplementary points. A crescent-shaped ridge in front of each pair of claws, crenate on the last legs, plain on the others. Eyes very small.

Length up to 500μ, pharynx 52μ, claws 24μ.

Related to *M. crenulatus*, RICHTERS, it is distinguished by the pharynx with three narrow rods, and the crescent crenate instead of closely wrinkled.

Cape Mary Harmsworth, Franz Josef Land, Spitsbergen. Also in Shetland.

M. arcticus, sp. n. (Plate I. figs. 5*a* to 5*f*) :—

Specific Characters.—Spiny eggs with rod-like blunt processes embedded in hyaline matrix. Egg small, oval or round; spines subclavate, slightly expanded, and blunt at tips. Pharynx short, oval; thickenings three in each row; first, nut, attached to gullet; second and third short rods, almost as broad as long; teeth curved, with bearers. Claws V-shaped, one of each pair longer, the long claw of one pair very long. Dark eyes.

The adult is unknown, but the young of *Macrobiotus* rarely differ in any important respect from the adult. Diameter of egg, over the spines, 83μ, pharynx in egg 20μ.

The only close relative is *M. hastatus*, MURRAY, which has egg spines similarly embedded in a hyaline matrix. The egg of that species is larger, the spines larger and more complex, the rods in the pharynx longer.

Prince Charles Foreland and Franz Josef Land (fig. 5*f*).

The egg from Franz Josef Land is smaller, oval, 65μ in long diameter. A similar egg to the smaller one, but with thicker spines, has been found in South Africa.

Another egg of the same type, but with shorter, round rods, occurred in Loch Ness, and is figured in "Scottish Tardigrada" (8), Plate IV. figs. 27*a* to 27*d*. The animal hatched from this last egg was very similar to *M. arcticus*.

M. pullari, MURRAY (8).—An egg found in Prince Charles Foreland resembles that of this species and *M. dispar*. In size it comes nearest to *M. pullari*.

M. islandicus, RICHTERS.—Though not definitely known to exist in Spitsbergen, some eggs found in Prince Charles Foreland and Recherche Bay (Plate I. figs. 2 and 3), though not exactly like RICHTERS' figure ("Isländische Tardigraden," p. 376), may belong to this species.

Macrobiotus, sp. (Plate I. fig. 4.)—A large egg, with hemispherical processes, also occurring in Novaya Zemlya and on Ben Lawers in Scotland. The species producing it is not yet known.

Genus DIPHASCON.

D. chilenense, PLATE (9).—Prince Charles Foreland. Previously known as an Arctic species only from Tromsö.

D. alpinum, MURRAY (6).—Prince Charles Foreland. Now known as Arctic, Antarctic, and from one mountain top in Scotland (6).

D. spitsbergense, RICHTERS (11). (Plate II. fig. 12.)—Prince Charles Foreland. Spitsbergen; Carpenter's Rock, Franz Josef Land.

D. scoticum, MURRAY (5).—Prince Charles Foreland and Recherche Bay, Spitsbergen; Cape Gertrude, Franz Josef Land. Of smaller size than *D. spitsbergense*, and easily known by the much more slender gullet. Only, as yet, known in northern lands. Three eggs in skin.

D. angustatum, MURRAY (4).—By the two narrow rods in the pharynx, the animal figured (Plate II. fig. 11) comes nearest this species, but has the rods narrower and the first relatively longer. It attained a length of 380μ. The encysted animal was seen.

Diphascon, sp. (Plate II. fig. 10.)—This insufficiently observed species has the rods in the pharynx as in *D. angustatum*, but is undoubtedly distinct, as the pharynx is relatively shorter and broader, and the gullet is very slender.

Diphascon, sp.—Also insufficiently studied, but distinct from all known species. There are four short rods in the pharynx, besides a nut and a comma. In this respect it resembles, among known species, only *D. chilenense*, but it has a thick gullet, relatively short. The claws are of the usual *Diphascon* type.

SUMMARY.

Including the species found in Mr BRUCE's collections, there are 40 species of Arctic Tardigrada on record. There are in addition 4 undescribed species which require further study, making a total of 44 species. Five of these species are as yet unknown, except in the Arctic Regions.

There are 32 of the Arctic species also found in Scotland, 17 in Central Europe, 9 in Asia, 5 in Africa, 6 in America, while 8 extend into the Antarctic Region.

Several of the records are of doubtful value—some of them refer to insufficiently described species, for ever unrecognisable—yet the majority are good species, and

there are undoubtedly many more to be discovered, as various eggs are known which cannot be referred to any of the described species.

In this paper the Arctic Region is restricted to the area within the Arctic Circle, following RICHTERS' practice in "Arktische Tardigraden," so that our results may be easily comparable. Climatically, Iceland, S. Greenland, and parts of Northern Europe outside the Arctic Circle should, no doubt, be treated along with the region within the Arctic Circle.

The term Antarctic Region in the following table has a laxer meaning, and includes all the lands south of the great continents for which any records are available. This treatment was necessitated by the different climate of the southern Polar Region, within which, defined as bounded by the Polar Circle, only one Tardigrade is known.

In the appended table of all the Arctic species known, the aim is to give a general view of the distribution of each species in Arctic lands and over the world. These records of distribution do not profess to be nearly complete, as I have failed to have access to several works containing records.

For the world distribution I am mainly indebted to the table in RICHTERS' "Arktische Tardigraden," but in order to give as comprehensive a view as I could, I have added many notes of Asian, African, and American species not yet published.

In the table the records are given under eleven headings, five of which give the principal Arctic lands for which we have records—the others being Scotland, Central Europe, Asia, Africa, America, and the Antarctic Region.

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COMPLETE LIST OF ARCTIC SPECIES (WITH GENERAL DISTRIBUTION).

	Arctic										
	Spitsbergen.	Franz Josef Land.	Novaya Zemlya.	Bear Island.	North Europe.	Scotland.	Central Europe.	Asia.	Africa.	America.	Antarctic Region.
Echiniscus arctomys, Ehr.	×	×			×	×	×	×	×		×
E. mutabilis, Murray	×	×				×		×			
E. wendti, Richters	×	×			×	×					
E. spitsbergensis, Scourfield	×	×	×		×	×					
E. borealis, sp. n.		×									
E. muscicola, Plate		×				×	×				
E. testudo, Doy.	×						×				
E. blumi, Richters	×					×	×				
E. oihonnæ, Richters	×				×	×	×				
E. merokensis, Richters					×						
E. victor, Ehr.					×		×				
E. spinulosus, Doy.	?						×				
E. spiculifer, Schaudinn	?										
Milnesium tardigradum, Doy.	×					×	×	×	×	×	
Macrobiotus oberhäuseri, Doy.	×				×	×	×	×			×
M. zetlandicus, Murray	×					×					
M. tetradactylus, Greeff	×				×	×	×			×	×
M. ornatus, Richters	×			×	×	×	×				
M. tuberculatus, Plate	×					×	×				
M. annulatus, Murray		×		×		×					
M. augusti, Murray		×				×					
M. macronyx, Duj.	×					×	×			×	
M. hufelandii, C. Sch.	×	×			×	×	×	×	×	×	×
M. intermedius, Plate	×	×			×	×	×	×		×	×
M. echinogenitus, Richters	×	×	×		×	×	×	×	×		×
M. dispar, Murray	×	×				×		×			
M. ambiguus, Murray	×	×				×					
M. pullari, Murray	×					×					
M. coronifer, Richters	×				×	×					
M. crenulatus, Richters	×	×				×					
M. granulatus, Richters					×						
M. harmsworthi, sp. n.	×	×				×					
M. arcticus, sp. n.	×	×				×			×		
M. islandicus, Richters	×					×					
M. dujardini, Doy.	×										
Diphascon chilenense, Plate	×				×	×	×	×		×	×
D. alpinum, Murray	×					×					×
D. spitsbergense, Richters	×	×				×					
D. scoticum, Murray	×	×				×					
D. angustatum, Murray	×	×				×					
	33	19	2	2	15	32	17	9	5	6	8

EXPLANATION OF PLATES.

PLATE I.

1. *Echiniscus borealis*, sp. n.
2. *Macrobiotus islandicus*, Richters? egg.
3. *Macrobiotus islandicus*, „ „
4. *M.*, sp.? egg.

5*a*. *M. arctlicus*, sp. n., teeth and pharynx.
5*b*. „ egg.
5*c*. „ some rods of the egg.
5*d*. „ claws.
5*e*. „ one pair claws, side view.
5*f*. *M. articus*, smaller oval egg.

6*a*. *M. crenulatus*, Richters, teeth and pharynx.
6*b*. „ side view of leg and claws.
6*c*. „ claws and wrinkled crescent.

7*a*. *M. harmsworthi*, sp. n., egg.
7*b*. „ teeth and pharynx.
7*c*. „ claws and crenate crescent.
7*d*. „ side view of claws.

PLATE II.

8*a*. *Echiniscus spitsbergensis*, Scourfield, var. *spinuloides*, var. nov.
8*b*. „ „ outer and inner claws.
8*c*. „ „ portion of surface marking.

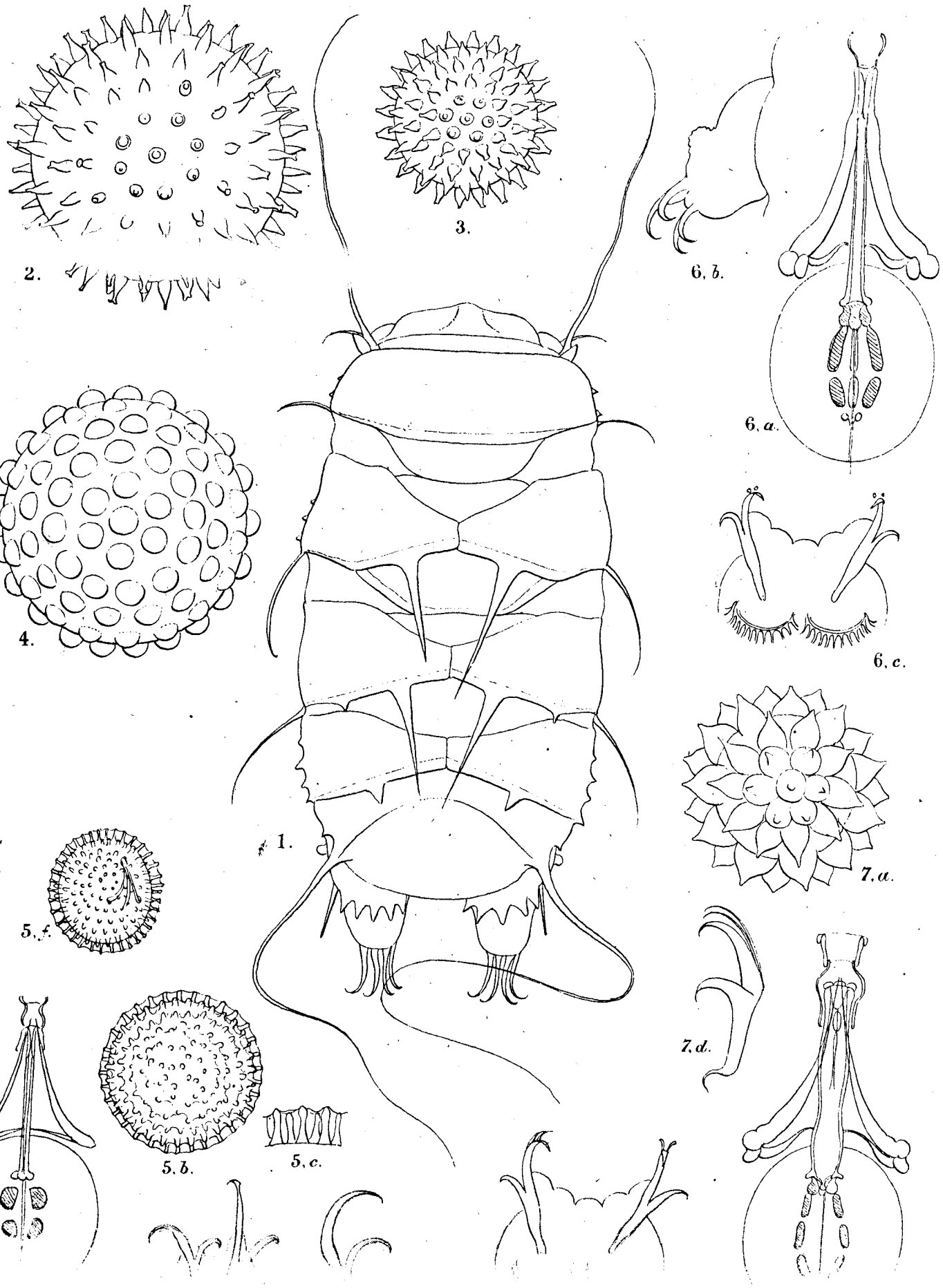
9*a*. *Macrobiotus*, with eggs attacked by parasite.
9*b*. „ pharynx.

10. *Diphascon*, sp., pharynx.
11. *D. angustatum*, Murray, pharynx.
12. *D. spitsbergense*, Richters? pharynx.

13*a*. *M. augusti*, Murray, gullet and pharynx.
13*b*. „ claws.

14*a*. *M. echinogenitus*, Richters, var. *areolatus*, var. nov., egg.
14*b*. „ pharynx in egg.
14*c*. „ furca of tooth.
14*d*. „ claws.

MURRAY: ARCTIC TARDIGRADA.—PLATE I.



MURRAY: ARCTIC TARDIGRADA.—PLATE II.