IV.—*African Tardigrada.*

By James Murray, F.R.S.E.

(*Read November* 20, 1912.)

Plates VI, VII.

In a paper contributed to this Journal in 1907 (*9*)* an account was given of some South African Water-bears, found in moss sent to me by Mr. Milne, of Uitenhage, Cape Colony.

In the present paper these notes on the Water-bears of South Africa will be supplemented from further material sent by Mr. Milne, and by various members of the staff of the Transvaal Museum, Pretoria. There will also be given a short account of the Water-bears of Tropical Africa, from material contributed by Mr. N. D. F. Pearce, of Cambridge, Mr. Alexander Allan, of Kikuyu, and Sir Philip Brocklehurst.

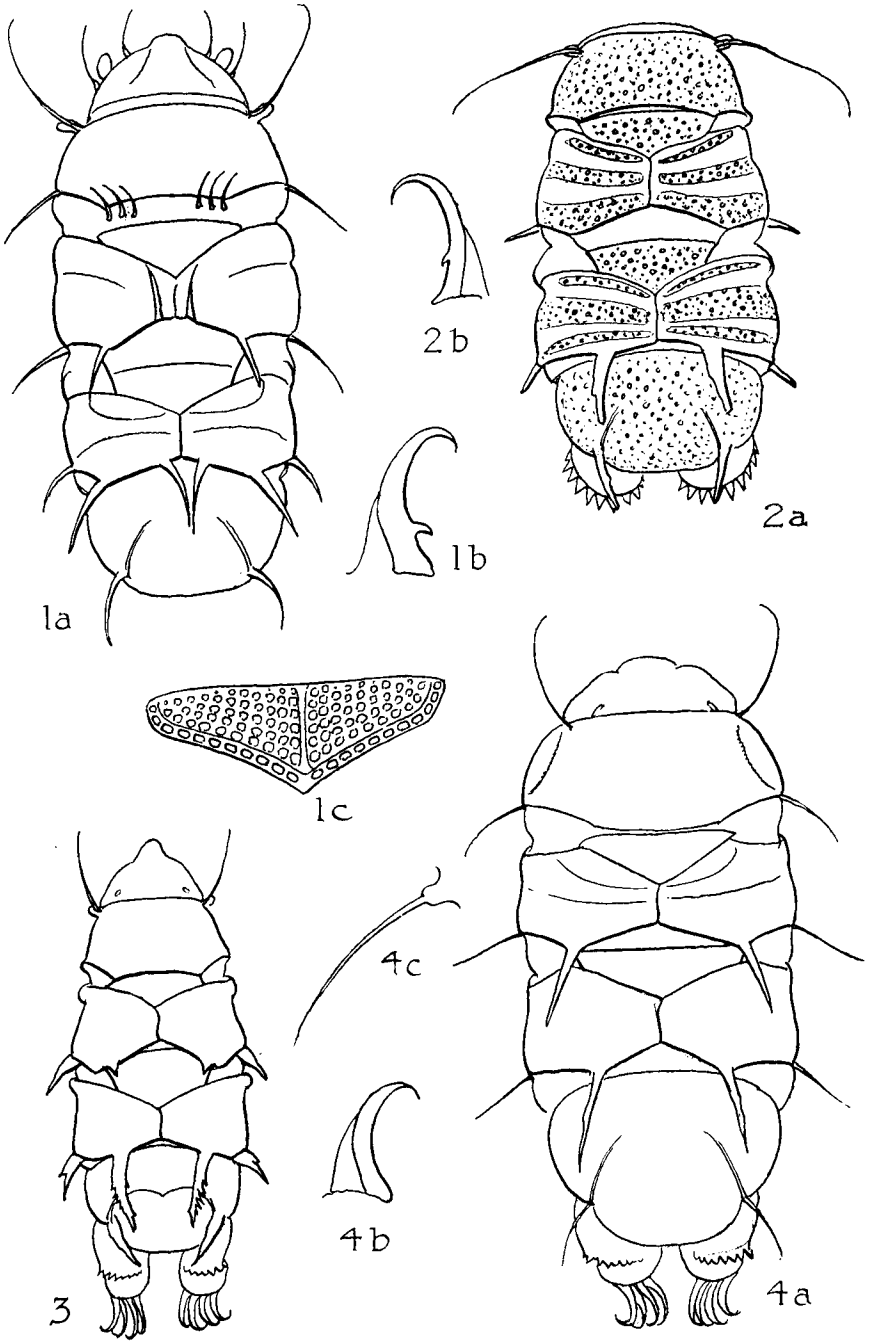
In a recent work of some importance (*19*) Thulin has made a revision of the classification of the Water-bears in genera, which involves a redistribution of a large number of species. It has been recognized for some time that a new genus was required for those species of *Echiniscus* which have an additional segment, consisting usually of a pair of plates, between the second pair and the end-plate, and Thulin's genus *Pseudechiniscus* supplies this want. The re-establishment of the genus *Arctiscon*, in place of the long-accepted *Milnesium*, seems to me to be required by the accepted rules of zoological nomenclature.

The re-establishment of Ehrenberg's genus *Hypsibius* may or may not be justified. I have not at present access to the literature which would enable me to examine the question on its merits. The only character in Ehrenberg's diagnosis which distinguishes

* The figures in brackets refer to the Bibliography at the end of paper.

EXPLANATION OF PLATE VI.

Fig. 1*a*.—*Echiniscus africanus* Murray.
,, 1*b*. Ditto. Inner claw.
,, 1*c*. Ditto. Second median plate.
,, 2*a*.—*Echiniscus crassispinosus* Murray, variety.
,, 2*b*. Ditto. Inner claw.
,, 3. — *Echiniscus duboisi* Richters, variety.
,, 4*a*.—*Echiniscus* sp.
,, 4*b*. Ditto. Claw.
,, 4*c*. Ditto. Lateral seta.



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the genus from *Macrobiotus* is the absence of eyes, which nobody now regards as of generic importance. Thulin rejects that character, and introduces one of his own, viz. the absence of a certain obscure rod connected with the gullet, which, he asserts, exists in *Macrobiotus*. This is a very unfortunate proceeding, since this rod has been seen, or its absence demonstrated, only in a very few species. Yet he groups the large number of species hitherto recognized as *Macrobiotus* in the two genera, separated only on this character, and he does not know in most cases whether the animals have the character or not. The result of this ill-considered classification is unhappy. We find united in the genus *Hypsibius* the most diverse animals, those with spiny eggs and those with smooth eggs, elongated gullets and short gullets, *Diphascon* claws and *Hufelandi* claws, etc.—in short, all the characters which have seemed available for the sub-division of the unwieldy *Macrobiotus* into several genera may be found in some species of Thulin's *Hypsibius*; and he crowns all by throwing in all the many species of *Diphascon*.

In some recent papers I have suggested the use of Schultze's name, Arctiscoida, for the order which includes the Water-bears, owing to the fact that the name Tardigrada had been previously used for a group of Vertebrates by Illiger.

There is no doubt as to the fact, but Professor Richters urges that Illiger's name was never widely accepted, and has fallen into complete disuse. How far he is right I do not know without a more thorough search through zoological text-books than I can at present make. Illiger's name is used in the Encyclopædia Britannica (ninth edition) only, it is true, as an alternative name for a group, and has found its way into some English dictionaries.

I have no desire to upset established names, unless for some very strong reason. All I seek is some stability for names, so that we may know what animal is referred to without consulting a voluminous synonymy, with all possible respect for the original authors of specific names.

There is a prevalent practice, sanctioned by rule, I believe, of tagging on to a species the name of the man who first used both generic and specific parts of the name together. Recently I found myself cited as the authority for a Rhizopod. Surely this is absurd! I never described a Rhizopod in my life, but it happened that I first referred to it and the genus to which it is at present considered to belong. It is true the original author's name was there, too, in brackets; but he described the beast well, and why should his name be dissociated from it as long as his specific name is retained?

There appears to be a confusion of ideas, a desire to tell too much in the specific name, as is also done in those groups in which specialists have introduced trinomial designations. I like the

beautiful simplicity of the Linnean binomial system, with the original authors' names appended for ever, and I quite approve of Jenning's practice of using the original author's name without any brackets to signify that the species is not now in its original genus.

I observe that there is quite a considerable revolt against the tyranny of the strict application of the rules of priority, as we have felt it in recent years.

TROPICAL AFRICA.

The Water-bears of Central Africa were obtained from mosses sent from Uganda by Mr. Pearce, and from British East Africa by Mr. Alexander Allan and Sir Philip Brocklehurst.

List of Species.

Echiniscus crassispinosus Murr.
E. quadrispinosus Richt.
Pseudechiniscus suillus Ehr.
Arctiscon tardigradum Schrank.
Macrobiotus hufelandii Schultze.
M. richtersii Murr.
M. harmsworthi Murr.
M. hufelandioides Murr.
M. intermedius Plate.
Macrobiotus crassidens Murr.
M. allani Murr. sp. n.
M. oberhäuseri Doy.
M. arcticus Murr.
M. rubens Murr.
M. nodosus Murr.
M. tuberculatus Plate.
M. indicus Murr.
Diphascon alpinum Murr.

Notes on the Species.

Echiniscus crassipinosus Murray (?) (*9*). Plate VI, figs. 2*a*, 2*b*.

Variety.—Agreeing with the type in the arrangement of the plates and processes, the paired plates show a character which was not observed in the original examples. Each plate of the pairs is divided into three dotted bands, separated by two plain bands without dots.

Habitat.—Kikuyu, British East Africa (coll. A. Allan).

Echiniscus sp. Plate VI, figs. 4*a*–4*c*.

Description.—Length 200 μ; red; plates 9, two median, two pairs. Lateral processes: *a*, seta; *b*, *c*, *d*, *e*, short fine setæ springing from small papillæ. Fringe of short teeth on fourth legs; all claws without barbs. Dorsal processes: over *c* and *d* at each side a straight stout spine, which is roughish. The dots on the plates are small, regular, and pellucid, and appear to be depressed papillæ.

Macrobiotus hufelandioides Murray (?) (*10*). Plate VII, figs. 5*a*–5*f*.

Variety.—Pharynx nearly round, with two short rods in each row, the one next the gullet twice as long as the other.

As the figures accompanying the original description only showed the specific characters, the African form is here figured, showing further details. The examples seen were smaller than those from Australia, measuring 250 μ in length. The claws are not so thick, and I could not see supplementary points, so conspicuous in the type. There are no eyes, and no "comma" in the pharynx. The fat-cells are few and very large, up to 20 μ in diameter. The first rod in the pharynx is about twice as long as broad, and is slightly constricted in the middle, as though formed by the union of two. The second is little longer than broad. No circlet or "kranz," as Richter calls it, could be detected at the base of the egg-process. The egg measures about 80 μ over the spines. Possibly a distinct species.

Habitat.—Uganda and British East Africa.

Macrobiotus crassidens Murray (*9*). Plate VII, figs. 6*a*, 6*b*.

When originally described, the egg was unknown. The species is very close to *M. intermedius* Plate, being mainly distinguished by the broader nuts in the pharynx. The egg was first found in Kikuyu, and proved to differ greatly from that of *M. intermedius*, while it resembled that of *M. aculeatus* (*10*).

Egg, diameter over shell 50 μ, over spines 70 μ. Processes closely set on the shell, almost touching at their bases; each with bulbous base, surmounted by slender undulate seta. Those of the egg of *M. aculeatus* are narrower, and stand apart, so that part of the shell can be seen between them.

Habitat.—Kikuyu, British East Africa (coll. A. Allan).

Macrobiotus allani sp. n. Plate VII, figs. 7*a*–7*d*.

Specific Characters.—Small; teeth and gullet very slender; pharynx nearly round, with three broad "nuts" and a "comma." Claws of *hufelandi* type, but slender, united for half their length. Egg shortly oval, or round, 80 μ in longest diameter, measured over the spines; processes close together on the shell, conical, each bearing several spines at the apex.

Length about 250 μ; no eyes.

The species belongs to a small group of which *M. intermedius* Plate (*14*) is the type. The group contains, besides that species, *M. crassidens* Murray and *M. aculeatus* Murray (*11*). These species are all very similar, and differ chiefly in their eggs. *M. aculeata*

has some pairs of spines on the body. *M. allani* is nearest to *M. crassidens*, and can only be distinguished by its eggs. The spines of the eggs of *M. crassidens* are long and slender, with bulbous bases.

Habitat.—Kikuyu (coll. A. Allan).

Macrobiotus oberhäuseri Doy. (*1*).

All the examples from Uganda and East Africa were very strongly papillose over the whole body, and brightly coloured, varying from the typical madder brown to vivid purple.

Macrobiotus arcticus Murray (*8*).

The supposed egg of this species was obtained in Uganda several years ago. It was much smaller than the type, and had fewer and thicker rods. An animal like the adult of the species occurred in Kikuyu, but there were no eggs with it.

Macrobiotus indicus Murray (*7*).

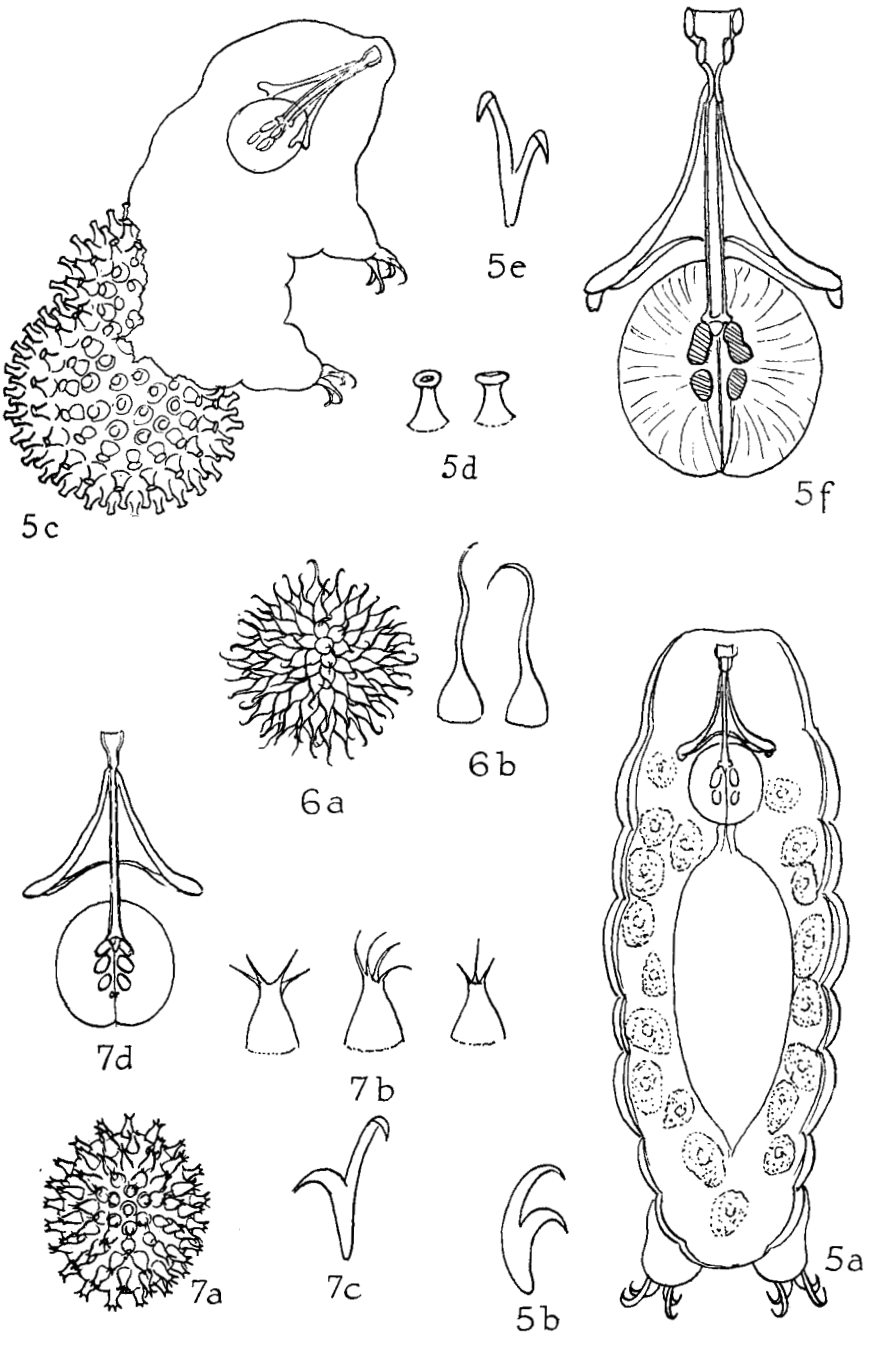
The one example seen was a "simplex." The claws were better seen than in the only Indian example, and show more approach to the *Diphascon* type than appears in the original figure.

Macrobiotus nodosus Murray (*9*).

Variety (not figured).—The knobs are very prominent, yet smaller than in the type. In the type they are so large that they occupy the whole surface of the segments and meet at their bases. These are only about half the diameter, and are separated at their bases. The whole skin of the body is finely papillose.

EXPLANATION OF PLATE VII.

Fig. 5*a*.—*Macrobiotus hufelandoides* Murray (?), variety. Adult.
,, 5*b*. Ditto. Claw of adult.
,, 5*c*. Ditto. Young emerging from egg.
,, 5*d*. Ditto. Processes of the egg.
,, 5*e*. Ditto. Claw of young.
,, 5*f*. Ditto. Teeth and pharynx, adult.
,, 6*a*.—*Macrobiotus crassidens* Murray. Egg.
,, 6*b*. Ditto. Processes of the egg.
,, 7*a*.—*Macrobiotus allani* sp. n. Egg.
,, 7*b*. Ditto. Processes of the egg.
,, 7*c*. Ditto. Claw.
,, 7*d*. Ditto. Teeth and pharynx.



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SOUTH AFRICA.

The Water-bears were obtained among the mosses sent from Cape Colony by Mr. Milne, from Pretoria by Mr. J. Hewitt, of the Transvaal Museum, and from the Northern Transvaal by Mr. Jenkyns, also of the Transvaal Museum.

List of Species.

Echiniscus africanus Murr.
E. duboisi Richt. var.
Macrobiotus richtersii Murr.
M. hufelandioides Murr.
Macrobiotus oberhäuseri Doy.
M. arcticus Murr.
Diphascon scoticum Murr.

Notes on the Species.

Echiniscus africanus Murr. (*9*). Plate VI, figs. 1*a*–1*c*.

The original description appears to have been made from immature examples—at any rate, no eggs have been seen. Larger examples have since been found, which necessitates the amending of the description. The differences are not serious, being merely the possession of additional spines. There can be no doubt as to the identity of the animals.

Description of larger and doubtless more mature example.—Length 200 μ; lateral processes: *a*, seta; *b*, *c*, *d*, *e*, curved spines, *b* finer than the others; dorsal processes: six curved acicular spines, in two groups, between the shoulder and first median plates: over *c* and *d* two curved spines on each side, one near the median line. Paired plates divided into three parts by curved lines, but dotted all over. Dots large depressions, regular, median plate with distinct posterior marginal row of subquadrate "cells." Second median plate interrupted in middle line by narrow plain band. Inner claw with small barb near the base.

Thulin (*19*) has recently described a new species, *E. lapponicus*, which is very close to *E. africanus*. The resemblance is closer than was supposed, since the diagnosis has been broadened by the finding of more mature examples.

E. lapponicus has not the acicular processes between II and III; the dots on the plates are described as clusters of smaller dots; the outer claws have straight barbs. The last character is not important, as it is known that in other species possessing outer barbs these only appear at one of the later moults.

Habitat.—Woodbush, Transvaal; coll. Mr. Jenkyns.

Echiniscus duboisii Richters (*15*). Plate VI, fig. 3.

Variety.—Small, red. Lateral processes: *a*, seta; *c*, short spine with enlarged base; *d*, short spine with enlarged base and a spicule near the middle; *e*, a strong curved spine. Dorsal processes: over *c* a small spicule, over *d* a strong serrate spine. End-plate facetted. No barbs on any claws.

Although this variety appears to differ considerably from Richters' type, I see no good reason to make a distinct species of it, as I have found a series of forms resembling *E. duboisii* in having some of the spines serrate, yet differing from one another in the number of serrate spines. Some have both lateral and dorsal spines serrate, others only the lateral, and others, again, only the dorsal.

Habitat.—Cape Colony (Mr. Milne).

Echiniscus sp.

Mr. Milne has sent me a sketch of an *Echiniscus* which has four stout, straight dorsal spines on the posterior half of the body, and no lateral processes except *a*. No such species has been described, but as Mr. Milne, not having made a special study of this group, fails to indicate on which plates the spines are situated, it cannot be described till the animal is again seen. I failed to find it in the moss sent to me.

Macrobiotus hufelandioides Murray (*10*).
Plate VII, figs. 5*a*–5*f*.

Variety.—As this was first found in moss sent by Mr. Pearce, a description will be found in the first part of this paper.

Habitat.—Woodbush (coll. Mr. Jenkyns).

Macrobiotus richtersii Murray (*12*).

Though only described in 1911, in a paper on Irish Tardigrada, the species had been long known. Professor Richters figured the egg in one of his papers, but without knowing the animal which produced it. The egg was also known to occur in Uganda and the Transvaal, but the complete study of the adult and the egg was not possible till the species turned up in Ireland.

The egg found in Africa belongs to the type, having large truncate conical processes, each surmounted by a disk, which is bordered with papillæ.

Habitat.—Pretoria (coll. J. Hewitt).

DISTRIBUTION OF AFRICAN SPECIES.

	Uganda	British East Africa	German East Africa	North Transvaal	Pretoria	Cape Colony
Echiniscus africanus Murray				×		×
E. crassispinosus Murray		×				×
E. perarmatus Murray						×
E. longispinosus Murray						×
E. duboisi Richters						×
E. quadrispinosus Richters		×				
Pseudechiniscus suillus (Ehr.)	×	×		×		×
P. bispinosus (Murray)						×
Arctiscon tardigradum Schrank	×	×			×	×
Macrobiotus hufelandii Sch.	×	×		×		×
M. richtersii Murray	×	×			×	×
M. echinogenitus Richters						×
M. harmsworthi Murray	×					
M. hufelandioides Murray	×	×		×		
M. intermedius Plate		×				
M. crassidens Murray	×	×			×	×
M. allani Murray		×				
M. oberhäuseri Doy.	×	×			×	
M. arcticus Murray		×			×	×
M. rubens Murray		×				
M. nodosus Murray	×	×			×	×
M. tuberculatus Plate		×				
M. tetronyx Daday			×			
M. indicus Murray		×				
Diphascon alpinum Murray	×					
D. scoticum Murray						×

Note.—The above list contains, in addition to the species which I have myself observed, only one species, *M. tetronyx* Daday.

SUMMARY.

There are now 26 species of Tardigrada recorded for all Africa, 19 for Tropical Africa, and 17 for South Africa. Twelve species are recorded in my previous paper; 13 are added in this.

Seven of the species are as yet only known in Africa. There is too little material to enable us to make a profitable study of the origin and distribution of the African Tardigrade fauna.

About half of the species are common, and widely distributed over the world; seven are confined to Africa. The remainder are of very limited range, and the distribution is in several instances discontinuous and peculiar.

E. perarmatus is only known in Africa and Hawaii; *E. duboisi* in Java, Australia, and Africa; *M. richtersii* in Ireland, Pacific

Islands, Africa, and South America; *M. hufelandioides* in Australia and Africa; *M. indicus* in India and Africa. *M. rubens* and *M. nodosus* are proving to have a wide extension, chiefly in tropical regions.

Bibliography.

1. Doyère, M. L.—Mémoire sur les Tardigrades. Ann. Sci. Nat. ser. 2, xiv., 1840.
2. Ehrenberg, C. G.—Novarum Speciorum Diagnoses. Verh. k. Akad. Wiss. Berlin, 1848
3. Flower—In Encyclopædia Britannica, 9th ed.
4. Hay, W. P.—A Bear-animal renamed. Proc. Biol. Soc. Washington, xix., 1907.
5. Murray, J.—The Tardigrada of the Scottish Lochs. Trans. Roy. Soc. Edin., xli., 1905.
6. „ „ Scottish Alpine Tardigrada. Ann. Scott. Nat. Hist., 1906.
7. „ „ Some Tardigrada of the Sikkim Himalaya. Journ. Roy. Micr. Soc., 1907.
8. „ „ Arctic Tardigrada, collected by William S. Bruce. Trans. Roy. Soc Edin., xlv., 1907.
9. „ „ Some South African Tardigrada. Journ. Roy. Micr. Soc., 1907.
10. „ „ Tardigrada. Brit. Antart. Exped. 1907-9. Scientific Rep., i. part 5, 1910.
11. „ „ Water-bears or Tardigrada (Supp. Paper). Journ. Quekett Micr. Club, April 1911.
12. „ „ Arctiscoida: Clare Island Survey. Proc. Roy. Irish Acad., xxxi. part 37, 1911.
13. Perty, M.—Die Familie Xenomorphidæ. Oken's Isis for 1834, Heft xii., 1835.
14. Plate, L.—Naturgeschichte der Tardigraden. Zool. Jahrb., Abt. f. Anat. u. Ontog. Bd. iii., 1908.
15. Richters, F.—Neue Moosbewohner. Ber. Senck. Naturf. Ges. Frankfurt-a-M., 1902.
16. „ „ Moosfauna Australiens etc. Zool. Jahrb. Abt. f. Syst. Bd. xxvi., 1908.
17. Schultze, C. A. S.—*Macrobiotus hufelandii*. Gratulationsschrift, Berlin, 1834.
18. „ „ *Echiniscus creplini*. Gryphæ, 1861.
19. Thulin, G.—Tardigradenfauna Schwedens. Ark. för. Zool. k. Sven. Vet. Akad. Stockholm, 1911.