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**An Annotated Catalogue of
Tardigrada in the
Collections of the
Royal Scottish
Museum, Edinburgh**

CLIVE I MORGAN

NATURAL HISTORY 5

JUNE 1977

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Museum, Edinburgh**

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INTRODUCTION

Between the years 1904 and 1913 James Murray made extensive collections of tardigrades from Britain and elsewhere (see Wallace, 1976; Waterston, 1976). Murray described fifty-four species new to science, and many of his illustrations and observations are still useful, and in frequent cases essential, for taxonomic purposes. Very little of Murray's preserved material remains, but the Royal Scottish Museum is fortunate in possessing representatives of fifteen species. Together with specimens recently donated by the present author, the tardigrade collection now comprises one of the most extensive museum reference collections available to workers in this field. The Morgan collection forms the basis for a recent Linnaean Society Synopsis of the British Tardigrada (Morgan and King, 1976a).

This catalogue forms part of a series aimed at increasing awareness of the significant collections held by the Natural History Department at the Royal Scottish Museum. Throughout this catalogue the classification and nomenclature outlined by Ramazzotti (1972) have been followed, and all identifications have been rechecked. Specimens are preserved as slide preparations, mounted in Canada Balsam (Murray material) or in Gurr's A.C.S. mountant ringed with Canada Balsam (Morgan material). Murray material carries the registration number 1921.144, distinguishing it from Morgan material registered in 1973, 1975 and 1976.

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PHYLUM TARDIGRADA

Order Heterotardigrada Marcus, 1927

Suborder Arthrotardigrada Marcus, 1927

Family Batillipedidae Ramazzotti, 1962

Genus *Batillipes* Richters, 1909

Type species: *Batillipes mirus* Richters, 1909

Batillipes acaudatus Pollock, 1971

1976.65.65 W92/S— Whitford Sands, Gower Peninsula, South Wales, May 1972.
Two specimens, both highly transparent. Legs have telescoped on fixation.

1976.65.66 W93/S Whitford Sands, Gower Peninsula, South Wales.
A single specimen distorted through compression.

Suborder Echiniscoidea Marcus, 1927

Family Echiniscidae Thulin, 1928

Genus *Echiniscus* C.A.S. Schultz, 1840

Type species: *Echiniscus bellermanni* C.A.S. Schultz, 1840

Subgenus *Bryodelphax* Thulin, 1928

Type species *Bryodelphax parvulus* Thulin, 1928

Echiniscus (Bryodelphax) parvulus (Thulin 1928)

1976.65.120 W9/S65. Mewslade, Gower, South Wales. September 1973
Six specimens all lacking pigmentation. Outline of cuticular plates and the sculpturing clearly visible.

Subgenus *Echiniscus* C.A.S. Schultz, 1840

Type species: *Echiniscus bellermanni* C.A.S. Schultz, 1840

1921.144.141 *Echiniscus* sp. Broughton, Peebles, Scotland. 24.7.1906.
A single specimen which is almost certainly *E. (E) blumi*.
Appendages B. C. D and Cd all filamentous; cuticular sculpturing poorly defined.

Echiniscus (Echiniscus) blumi Richters, 1903

1976.65.152 Sc29/S37. Lynchat to Kingussie, Scotland. September 1972
Specimens obtained from moss growing on a stone wall. Numerous individuals on this slide, the largest 340 μ m in length. All are very lightly pigmented with the characteristic cuticular sculpturing easily discernible. The "*blumi* type" sculpturing is an important diagnostic feature used in the identification of several tardigrade species.

Echiniscus (Echiniscus) granulatus (Doyère, 1840)

- 1976.65.17 E30/-. A436, Chipping Norton to Stow. December 1971. In moss from stone wall at the roadside. 20 specimens, all lacking lateral filaments B. Cuticular sculpturing, of the *E. (E) blumi* type, distinct.
- 1976.65.23 E44/-. Stow on the Wold, Gloucestershire. Wall of Botanic Garden. December 1971. 2 specimens, both lacking lateral filaments B.
- 1976.65.72 W25/-. Old Forge, Moss, Parkmill, South Wales, August, 1971. Three specimens from moss at the edge of a stream, all lacking lateral filaments B.
- 1976.65.139 W83/-. Penrice Towers, Gower, South Wales. Roadside wall. September 1971. Four specimens, one with lateral filaments at the B position. (See Morgan and King, 1976a). Sculpturing of the cuticle distinct.

Echiniscus (Echiniscus) kerguelensis Richters, 1904

- 1976.65.53 Sc23/S18. Ben Nevis, Scotland, 4406'. September, 1972. A single specimen, 175 μm . in length. Distinguished from the very similar *E. (E.) wendti* by the length of the cirri A and the granulation/sculpturing of the cuticular plates.
- 1976.65.54 Sc24/S27. Kinlochewe to Achnasheen, Scotland. September, 1972. Three specimens, 160-170 μm . in length with cirri A 30-35 μm ., much shorter than usual.
- 1976.65.55 Sc25/S19. Ben Nevis, Scotland, 4406'. September 1972. A single specimen 210 μm in length. Cuticle with a distinct, fine, regular granulation.
- 1976.65.121 Sc20/S20. Ben Nevis, Scotland, 4406'. September, 1972. A single specimen, 135 μm . in length with cirri A 57 μm . The teeth of the dentate collar are small and numerous and unlike *E. (E.) arctomys*, there is no long spine on each of the first pair of legs.

Echiniscus (Echiniscus) merokensis Richters, 1904

- 1976.65.17 E30/-. A436, Chipping Norton to Stow. December 1971. A single specimen of the variety *suecicus*, that is bearing lateral filaments B. Animal 260 μm in length.
- 1976.65.49 Sc9/S14. Rannoch Moor, Scotland. Nine specimens, including both the normal form and the variety *suecicus*. Body length varies from 110-210 μm .
- 1976.65.51 Sc11/S15. Glencoe, Scotland. September, 1972. A single specimen, 150 μm in length.
- 1976.65.52 Sc12/S16. Foot of Ben Nevis, Scotland. September 1972. Several specimens, all with lateral filaments B. (that is var. *suecicus*).
- 1976.65.57 Sc28/S36. North of Dunrobin Castle, Scotland. September, 1972. A mixture of the normal form and the variety *suecicus*.
- 1976/65.81 Sc3/S4. Bargrennan to Loch Moan, Scotland. September 1972. Nine specimens 180-230 μm in length. Facetting of terminal plate and cuticular sculpturing clearly visible.
- 1976.65.142 W72/-. Natural Sciences Building Roof, University, Swansea, South Wales. April 1971. A badly crumpled specimen with distinct cuticular sculpturing.

Echiniscus (Echiniscus) quadrispinosus Richters, 1902

- 1921.144.130 *E. cribrosus*. Loch Morar, Scotland. 27.7.1906. A single moulted skin with two eggs of *E. (E) quadrispinosus* var *cribrosus*. The number and arrangement of body appendages appear inconsistent with the original description but this could be the result of distortion through age.
- 1921.144.142 *Ech. var cribrosus*. Nerston, Scotland. 11.1906. A very good specimen of *quadrispinosus*, although not all of the spines Cd and Dd are evident.
- 1921.144.143 *E. cribrosus*. Broughton, Peebles, Scotland. 24.7.1906. A single specimen with good cuticular sculpturing.

Echiniscus (Echiniscus) reticulatus Murray, 1905

- 1921.144.135 *E. reticulatus*. Loch Morar, Scotland. Two eggs, 27.8.1906. A single moulted skin with two eggs obscured by a cracked coverslip.
- 1921.144.138 *E. reticulatus*. Loch Morar, Scotland. 27.7.1906. A single specimen, poorly preserved but with cirrus A (about two thirds length of body) clearly visible.
- 1921.144.139 *E. reticulatus*. Loch Morar, Scotland, 27.7.1906. The specimen is crumpled but the characteristic reticulate sculpturing is prominent. Significantly, the sculpturing is of much greater dimensions in relation to the size of the body than is suggested by Murray's original description and illustration. *E. (E) reticulatus* has only ever been recorded in Scotland, the Himalayas, and the Carpathians so that this selection of slides (numbers 135, 138 and 139) represents a valuable, and possibly unique, source of reference material.

Echiniscus (Echiniscus) spinulosus (Doyère, 1840)

- 1976.65.2 W12/S68 Horton, Gower, South Wales. P.K. August 1973. Specimen approximately 265 μ m in length. Appendages Cd and Dd are spinose and small teeth present in lateral positions.

Echiniscus (Echiniscus) spitsbergensis Scoufield, 1897

- 1975.52.4 W67/- Penrice Towers, Gower, South Wales (A.O.) Roadside moss. A single specimen with lateral appendages A, B, C and D filamentous, while E is spinose. The cuticular sculpturing is of the *E. (E) blumi* type.

Echiniscus (Echiniscus) testudo (Doyère, 1840)

- 1973.22.3 Swansea, South Wales. *Xanthoria* sp. April 1971. *E. (E.) testudo*, the most common species of *Echiniscus* in Britain, is frequently to be found in *Xanthoria*, orange/yellow lichens which encrust rock and roof surfaces.
- 1973.22.4 Cafer Kule, Turkey. 2,800 m August 1971. Specimens of both varieties of *E. (E.) testudo*, var *quadrifilis* with lateral filament B, var *trifilis* without. Lateral appendages are extremely long by comparison with average British specimens. Cuticular sculpturing pronounced.
- 1973.22.5 Swansea, South Wales. *Bryum* sp. April 1973. The ubiquitous city dwelling moss *Bryum argenteum* provides a particularly favourable habitat for *E. (E.) testudo* which is to be found in the water droplets collected in leaf axils and amongst the debris of decomposing moss filaments. In such a habitat the species has been the subject of an intensive two year population study. (Morgan, 1977)
- 1976.65.10 E16/S48. Taunton, Somerset. January 1973.
- 1976.65.11 J4/S102. St Helier, Jersey. Above harbour, moss. April, 1974
Twenty five specimens of the variety *trifilis* ranging in length from 126 μ m to 342 μ m.

- 1976.65.12 E27/— Hungary Hall, Bucks. December 1971.
- 1976.65.14 W2/S2. Newtown, Montgomery, Wales. Specimen of *trifilis* 230 μm . in length with very prominent cuticular sculpturing, much heavier than is usual. The claws of the hind pair of legs long, 27.5 μm , and with recurved hooks.
- 1976.65.20 E40/— Wall of Botanic Garden, Stow on the Wold, Gloucestershire. December 1971. Specimens of var. *quadrifilis*.
- 1976.65.23 E44/— Wall of Botanic Garden, Stow on the Wold, Gloucestershire. December 1971.
- 1976.65.58 E57/— Hungary Hall, nr Olney, N. Bucks. December 1971. Ruined farm alongside disused railway.
- 1976.65.31 Sc35/S12. Loch Lomond, Scotland. September 1972. A single specimen of var *trifilis*, 155 μm in length. This specimen was found in moss subject to immersion at the edge of Loch Lomond, an unusual choice of habitat for an otherwise "terrestrial" tardigrade species.
- 1976.65.33 I1/— Bellmullet, Carne House, Eire. Moss. April 1971. Two specimens.
- 1976.65.35 E3/S47. Copnor, Portsmouth. Moss from a stone wall. January 1973.
- 1976.65.46 I3/— Bellmullet, Carne House, Eire. Two specimens found in wall moss. 270 μm and 255 μm in length.
- 1976.65.56 Sc26/S34. Junction of A836 and A897, near Melvich, Scotland. September, 1972. Thirteen specimens of the variety *trifilis*; a single specimen of *quadrifilis*, 286 μm long, with only one lateral filament B, 65 μm long, on the left hand side of the body. All specimens with very long lateral filaments E, two thirds of body length.
- 1976.65.59 Sc30/S38. Dalkeith, Scotland. September 1972. Specimens obtained from moss (*Bryum argenteum*) collected in the town centre. Three var. *quadrifilis* and three var. *trifilis* with a *quadrifilis* cast (185 μm in length) containing two eggs.
- 1976.65.68 J2/S99. Jersey. Mt. Bingham. Emplacement. Moss. A single specimen of the variety *trifilis*.
- 1976.65.71 J9/S109. Jersey. La Paleute. Orange lichen. April 1974. Nine specimens.
- 1976.65.74 W27/— Pennard, Gower Peninsula, Wales. June 1972.
- 1976.65.75 W28/— Llandovery, Wales. Moss from an old stone bridge in town centre. September 1972.
- 1976.65.76 W29/— Carmarthen, Wales. December 1971. Moss from the walls of electricity installations on the A40, west of Carmarthen. A large number of specimens of both varieties.
- 1976.65.87 W32/— Haverfordwest, Wales. Barn St. Wall moss. January 1972. Five specimens of var. *trifilis*, one equipped with extremely large dorsal spines, 35 μm in an animal of 300 μm body length.
- 1976.65.88 W4/S46. Bangor, North Wales. January 1973.
- 1976.65.89 W21/— Carmarthen to St Clears Road, Carmarthen, Wales. December 1971.
- 1976.65.93 W45/— Limeslade, Gower, South Wales. Wall moss. February 1971.
- 1976.65.98 W55/— Natural Sciences Building, University, Swansea, South Wales. May 1972. Specimens of var. *trifilis* including one with three lateral filaments at position E.
- 1976.65.99 W54/— Botany Department Annexe, University, Swansea, South Wales. January 1972. Several specimens including one with three lateral filaments at position E.

- 1976.65.108 W51/-. Killay, Swansea, South Wales. November 1972. The variety *trifilis*, including casts with eggs.
- 1976.65.109 W46/-. Limeslade, Gower, South Wales. February 1971. All specimens of the variety *trifilis*, found in the yellow lichen *Xanthoria*.
- 1976.65.114 W64/-. Natural Sciences Building, University, Swansea, South Wales. May 1973. Both varieties of *E.(E.) testudo* are represented on this slide.
- 1976.65.115 W73/-. Natural Sciences Building Roof, University, Swansea, South Wales. May 1972. In addition to normal individuals this slide includes a specimen of the variety *quadrifilis* with three lateral filaments at position E.
- 1976.65.122 W82/-. Natural Sciences Building, University, Swansea, South Wales. March 1972. One of a number of slides in the Museum's collections which formed part of a two year study of the population dynamics of *E.(E.) testudo*. (Morgan 1977)
- 1976.65.123 W62/-. Natural Sciences Building, University, Swansea, South Wales. May 1972.
- 1976.65.124 W94/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.126 W93/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.127 E39/-. Wall moss. Truro, Cornwall. May 1972.
- 1976.65.132 W85/-. *Xanthoria* sp. Limeslade, Gower, South Wales. October 1970. A large number of individuals including casts with eggs.
- 1976.65.137 W81/-. Upper Killay, South Wales. Moss. August 1971.
- 1976.65.142 W72/-. Natural Sciences Building Roof, University, Swansea, South Wales. April 1971.
- 1976.65.145 W92/-. Natural Sciences Building Roof, University, Swansea, South Wales. March 1972.
- 1976.65.146 W74/-. Botany Department Annexe Roof, University, Swansea, South Wales. November 1971. Numerous specimens on this slide, including one very unusual individual with duplication of some appendages (filaments E.) while others appear forked.
- 1976.65.148 W88/-. Gutter moss. Botany Department Annexe, University, Swansea, South Wales. January 1974.
- 1976.65.149 W79/-. Specimens from orange lichen (*Xanthoria* sp.) collected at Limeslade, Gower Peninsula, South Wales. November 1970.
- 1976.65.150 W75/-. Botany Department Annexe Roof, University, Swansea, South Wales. March 1972. A large number of specimens, some displaying very interesting damage repair.
- 1976.65.151 W91/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.

Echiniscus (Echiniscus) trisetosus Cuénot, 1932

- 1921.144.131 *E. granulatus*. Loch Morar, Scotland. 27.7.1906. Although the specimen is rather poor it does not conform to the description of *E.(E.) granulatus*. The dorsal appendages at Cd are filamentous and those at Dd spinous, suggesting *E.(E.) trisetosus*. Le Gros, who examined the Murray collection in 1956, agrees with this latter determination.

- 1921.144.132 *E. granulatus*. Loch Morar, Scotland. 27.7.1906. This specimen again probably is *trisetosus* and despite having moved to the edge of the cover slip under the sealing compound, the cuticular sculpturing (of the *E.(E.) blumi* type) is very distinct.
- 1973.22.4 Cafer Kule, near Mergan, Turkey, 2,800m. August 1971. There are few records of tardigrades from Turkey. The material on this slide was collected from north facing rock surfaces at 2,800 metres.

Echiniscus (Echiniscus) wendti Richters, 1903

- 1976.65.48 Sc8/S13. Dunbarton to Inverary, Scotland. Highest point of A83. September 1972. A single specimen, 217 μ m in length, with characteristically long cirri A, 125 μ m.
- 1976.65.49 Sc9/S14. Rannoch Moor, Scotland. Two specimens, found in roadside moss.
- 1976.65.51 Sc11/S51. Glencoe, Scotland. September 1972. Several specimens.
- 1976.65.52 Sc12/S16. Foot of Ben Nevis, Scotland. September 1972.
- 1976.65.53 Sc23/S18. Ben Nevis, Scotland. 4406'. September 1972. Large specimen, 210 μ m in length, with very prominent cuticular granulation, much more intense than in *E.(E.) kerguelensis*.
- 1976.65.54 Sc24/S27. Kinlochewe to Achnasheen, Scotland. September 1972. Nine specimens, found in roadside moss.
- 1976.65.82 Sc4/S5. Bargrennan to Straiton, Scotland, 1407'. September 1972. Five specimens, the largest 250 μ m in length, collected from moss on roadside boulders.

Subgenus *Hypechiniscus* Thulin, 1928

Type species: *Echiniscus gladiator* Murray, 1905

Echiniscus (Hypechiniscus) gladiator Murray, 1905

- 1921.144.133 *E. gladiator* (and two eggs) Loch Morar, Scotland. 27.8.1906. A very poorly preserved specimen.
- 1921.144.134 *E. gladiator*. Loch Morar, Scotland. A single specimen with dorsol spine clearly visible but very poor delineation of cuticular plates, almost a characteristic of this species.
- 1921.144.136 *E. gladiator*. Loch Morar, Scotland. A single specimen in very good condition.
- 1921.144.137 *E. gladiator*. Loch Morar, Scotland. A well preserved specimen with characteristic squat shape.
- 1921.144.146 *Echiniscus gladiator*. Two eggs. Loch Morar, Scotland. A cast skin with two eggs, lacking dorsal spine.
- 1976.65.54 Sc24/S27. Kinlochewe to Achnasheen, Scotland. September 1972. A single specimen, 166 μ m in length.
- 1976.65.135 W47/-. Cwm Idwal, North Wales. October 1971. Two specimens, both lacking pigmentation.

Genus *Pseudechiniscus* Thulin, 1911

Type species: *Echiniscus suillus*. Ehrenberg, 1853

Pseudechiniscus suillus (Ehrenberg, 1853)

- 1921.144.128 *E. mutabilis*. Loch Morar, Scotland. 27.7.1906. Slide contains a single cast skin with five eggs. *E. mutabilis* is a synonym for *P. suillus*.
- 1921.144.129 *E. mutabilis*. Larva. Loch Morar, Scotland. In the family Echiniscidae the juveniles have only two claws per foot, compared with four in the adults.
- 1921.144.144 *Echiniscus mutabilis*. Loch Ness, Scotland. February 1906. A single cast with two eggs, providing a very good lateral view of plates and sculpturing.
- 1976.65.29 Sc32/S43. Oban, Scotland. Walls of Dunstaffnage Castle. September 1972. Ten specimens extracted from moss.
- 1976.65.54 Sc24/S27. Kinlochewe to Achnasheen, Scotland. September 1972
- 1976.65.57 Sc28/S36. North of Dunrobin Castle, Scotland. September 1972. Three specimens, all about 175 μ m in length and poorly pigmented.

Order Eutardigrada Marcus, 1927

Family Macrobiotidae Thulin, 1928

Genus *Macrobiotus* C.A.S. Schultze, 1834

Type species: *Macrobiotus hufelandii* C.A.S. Schultze, 1834

Macrobiotus areolatus Murray, 1907

- 1975.52.1 J10/S110. Verclût Point, Jersey. April, 1974. Two specimens. Characteristically, the microplacoid is missing from the pharyngeal bulb.
- 1976.65.7 E13/S63. Darriti's Hole, Isles of Scilly. August 1973. A single adult specimen and egg. The egg of *M. areolatus* is important taxonomically, aiding separation of the species from the very similar *M. harmsworthi* and *M. richtersi* (Morgan, 1976).
- 1976.65.8 E14/S63. Darriti's Hole, Isles of Scilly. August 1973. Two adult specimens and two eggs.

Macrobiotus coronifer Richters, 1903

- 1921.144.67 *M. coronifer*. Lerwick, Shetland. The single specimen would appear to have been stained and as such as is unrecognisable.
- 1976.65.55 Sc25/S19. Ben Nevis, Scotland, 4406'. September 1972. A single specimen bearing the characteristic dentate lunule at the base of the claws on each leg.
- 1976.65.121 Sc20/S20. Ben Nevis, Scotland 4406'. September 1972. A single specimen, 462 μ m in length, with two quadrangular macroplacoids in the pharyngeal bulb, 12.5 μ m and 7.5 μ m in length respectively.

Macrobotus dispar Murray, 1907

- 1921.144.164 *M.dispar*. Three cysts. Nerston, Scotland. Three cysts in a fairly good state of preservation.
- 1921.144.165 *Macro. dispar*. Cysts. January 1906.
- 1921.144.166 *Macrobotus dispar*. Shetland. Single specimen, badly distorted.
- 1976.65.148 W88/-. Gutter moss. Botany Department Annexe, University, Swansea, South Wales. January 1974. Not an optimal habitat for an aquatic species. A single juvenile specimen with disproportionately large *macronyx* type claws. The elusive cuticular granulation is distinct but very finely scattered.

Macrobotus echinogenitus Richters, 1904

- 1921.144.61 *Macrobotus crenulatus*. Ronas Hill, Shetland. A single specimen of *echinogenitus*, the characteristic, slender, v-shaped claws readily distinguishable.
- 1921.144.147 *Macrobotus crenulatus*, Shetland. Pharyngeal apparatus particularly well preserved on this specimen of *echinogenitus*.
- 1921.144.148 *Macro.echino* - Loch Ness, Scotland. March 1906. Unfortunately this slide is suffering from the ravages of time and is of little use for taxonomic purposes.

Macrobotus harmsworthi: Murray, 1907

- 1921.144.151 *Macro. harmsworthi*. Ronas Top, Shetland
- 1921.144.169 *Macro harmsworthi*: Ronas Top, Shetland. A single specimen with clearly defined pharyngeal apparatus.
- 1976.65.143 W13/S69. Mewslade, Gower, South Wales. August 1973. A single specimen in moss from this coastal location. No egg present but the buccal tube ratio (Morgan, 1976) is 0.137, indicating *harmsworthi* and not *areolatus* or *richtersi*.

Macrobotus hibernicus Murray, 1911

- 1976.65.137 W81/-. Upper Killay, South Wales, Moss. August 1971. A single egg with an external hyaline zone in which short rods are embedded, occasionally projecting above the surface. The egg is embraced in the front legs of a specimen of *E. (E.) testudo*.

Macrobotus hufelandii S Schultze, 1834

- 1973.22.5 Swansea, South Wales *Bryum* sp. April 1973. The ubiquitous *M.hufelandii* is frequently found in *Bryum argenteum*, a common moss between paving stones in city areas.
- 1975.52.5 Sc3/S12. Loch Lomond, Scotland. Moss. September 1972 *M.hufelandii* is frequently found in aquatic situations; the specimens on this slide were recovered from moss subject to periodic immersion at the edge of Loch Lomond.
- 1976.65.6 W5/-. Pennard, Gower, South Wales. (lichen) August 1972 Another example of different habitat frequently colonised by *M.hufelandii*. The preparation also includes several eggs, important for accurate determination of the species.
- 1976.65.10 E16/S48. Taunton, Somerset. January 1973.
- 1976.65.11 J4/S102. Jersey, St Helier. Above harbour, moss. April 1974 Three specimens.

- 1976.65.12 E27/-. Hungary Hall, Bucks. December 1971.
- 1976.65.15 W18/S73. Flatholm, Bristol Channel. August 1973. A large number of individuals with some well preserved eggs. The eggs of *M.hufelandii* are spherical and can range from 55 μm to 140 μm in diameter, including the projections (from 6 μm to 12 μm in height) which take the form of inverted goblets or egg cups.
- 1976.65.17 E30/-. A436, Chipping Norton to Stow. December 1971
- 1976.65.21 E42/-. Isle of Man. August 1972.
- 1976.65.23 E44/-. Stow on the Wold, Wall of Botanic Garden. December 1971.
- 1976.65.24 E50/-. Kestor Rock, near Chagford, Dartmoor. Stone parapet. November 1971.
- 1976.65.25 E51/-. Fortescue Cairn, 1350', Devon.
- 1976.65.26 E53/-. Batworthy, near Chagford, Dartmoor. Lichen. November 1971.
- 1976.65.27 E56/-. *Sphagnum* sp. Ross-on-Wye, Herefordshire. March 1971.
As a general rule, *Sphagnum* moss is an unfavourable habitat for tardigrades, being too acid. Occasionally small numbers of *M.hufelandii* are found in strands of this moss species.
- 1976.65.28 Hungary Hall, near Olney, N. Bucks. December 1971. Ruined farm alongside disused railway.
- 1976.65.30 Sc33/S12. Loch Lomond, Scotland. September 1972. Several specimens recovered from moss subject to periodic immersion on the shore of the Loch.
- 1976.65.31 Sc35/S12. Loch Lomond, Scotland. September 1972. One specimen with brown pigmentation.
- 1976.65.35 E3/S47. Copnor, Portsmouth, Hampshire. January 1973. Moss from a stone wall.
- 1976.65.36 I12/-. Carne House, Belmullet, Eire. August 1971. Seven specimens of *hufelandii* found in wall moss collected from the old orchard at Carne House.
- 1976.65.38 E9/S53. Padstow, Cornwall. August 1973.
- 1976.65.41 I6/-. Carne House, Belmullet, Eire. April 1971. Wall and trees. A single specimen.
- 1976.65.42 I8/-. Mullet Point, Belmullet, Eire. March 1972. Two specimens.
- 1976.65.44 I5/-. Aran Isles, Ireland. (P.K.) September 1971.
- 1976.65.45 I4/-. Carne House, Belmullet, Eire. March 1971. One simplex, that is an individual which has just resorbed its pharyngeal apparatus prior to moulting.
- 1976.65.46 I3/-. Carne House, Belmullet, Eire. A single specimen in wall moss.
- 1976.65.47 Sc7/S11. Loch Achray, Trossachs, Scotland. September 1972. A single specimen in moss subject to immersion from the edge of the Loch.
- 1976.65.48 Sc8/S13. Dunbarton to Inverary, Scotland. Highest point of A83. September 1972. Six specimens.
- 1976.65.49 Sc9/S14. Rannoch Moor, Scotland. Ten specimens, extracted from roadside moss.
- 1976.65.50 Sc10/S12. Loch Lomond, Scotland. September 1972. Three specimens in moss from stones subject to immersion from the east side of the Loch.
- 1976.65.61 Sc11/S15. Glencoe, Scotland. September 1972. Five specimens.
- 1976.65.52 Sc12/S16. Foot of Ben Nevis, Scotland. September 1972.
- 1976.65.54 Sc24/S27. Kinlochewe to Achnasheen, Scotland. September 1972. Twelve specimens extracted from roadside moss.

- 1976.65.55 Sc25/S19. Ben Nevis, Scotland, 4406'. September 1972.
- 1976.65.56 Sc26/S34. Junction of A836 and A897, near Melvich, Scotland. September 1972.
- 1976.65.57 Sc28/S36. North of Dunrobin Castle, Scotland. September 1972.
- 1976.65.58 Sc30/S38. Dalkeith, Scotland. September 1972. Thirty specimens in the moss *Bryum argenteum* collected in the town centre.
- 1976.65.59 Sc15/S23. Loch Lochy, Scotland. September 1972.
- 1976.65.60 Sc16/S29. Dingwall to Bonar Bridge, September 1972. Twenty-one specimens.
- 1976.65.61 Sc17/S31. Betty Hill, Sutherland, Scotland. September 1972. Specimens extracted from moss encrusting wall and rock surfaces.
- 1976.65.62 Sc18/S32. Betty Hill, Sutherland, Scotland. September 1972. Six specimens.
- 1976.65.63 Sc19/S30. Altnahara, Sutherland, Scotland. September 1972. A single specimen.
- 1976.65.64 Sc21/S28. Loch Croisg, Scotland. September 1972. A single specimen in moss from the water's edge.
- 1976.65.67 J1/S97. Jersey, St Brelade Churchyard. Moss. Fourteen adult specimens and two eggs. Most observations of egg laying in *M. hufelandii* have involved individuals greater than 360 μm in length. Egg laying, which often accompanies moulting, can continue throughout the life of the animal. However, in Britain the species rarely exceeds 540 μm in length, far below the recorded maximum of 1200 μm (Ramazzotti 1972) and consequently its reproductive potential is reduced (Morgan, 1977).
- 1976.65.69 J5/S101. Jersey. Highlands College, St Samsons. Moss. Five specimens and one egg.
- 1976.65.71 J9/S109. Jersey. La Paleute. Orange lichen. April 1974. Five specimens extracted from *Xanthoria* sp.
- 1976.65.72 W25/-. Old Forge, Parkmill, South Wales. Moss. August 1971.
- 1976.65.74 W27/-. Pennard, Gower Peninsula, South Wales. June 1972.
- 1976.65.76 W29/-. Carmarthen, South Wales. December 1971.
- 1976.65.77 W30/-. Solva, Wales. Harbour wall. January 1972.
- 1976.65.79 J12/S112. Jersey. L'ille de Bas, High water. Moss. April 1974. Three specimens, one with brown granulation. A number of tardigrades appear to be capable of surviving in the splash zone on the sea shore.
- 1976.65.80 Sc2/S3. Castle Douglas, Scotland. September 1972. Seventeen specimens, in moss from a dry stone wall. Several of the specimens are pigmented, either uniformly or with variously arranged brown granules. The development of pigmentation is common among older individuals and there is some evidence to suggest it may be correlated with environmental variables (Morgan 1977).
- 1976.65.81 Sc3/S4. Bargrennan to Loch Moan, Scotland. September 1972. Thirteen specimens.
- 1976.65.82 Sc4/S5. Bargrennan to Straiton, Scotland 1407'. September 1972. Eleven specimens.
- 1976.65.83 Sc5/S8. Queen Elizabeth Forest Park, Scotland. September 1972. Six specimens.
- 1976.65.84 W31/-. Newgale Bridge, Wales. Wall moss. January 1972.

- 1976.65.85 W35/-. Skomer Is., Wales. Moss. Old stone wall. August 1972.
- 1976.65.86 W34/-. Nant Bran, Black Mountains, Wales. Stream edge 1200'. October 1971. Although not an aquatic species *M. hufelandii* is frequently found in semi-aquatic situations, in addition it occurs throughout a wide range of altitude.
- 1976.65.87 W32/-. Barn Street, Haverfordwest, Wales. Wall moss. January 1972.
- 1976.65.88 W4/S46. Bangor, North Wales. January 1973.
- 1976.65.89 W21/-. Carmarthen to St Clears Road, South Wales. December 1971.
- 1976.65.91 W23/-. Parkmill Lane, Swansea, South Wales. Moss.
- 1976.65.92 W24/-. Rhossili Down, South Wales. Moss. 250' December 1971.
- 1976.65.96 W58/-. Ynysybwl, South Wales. March 1972.
- 1976.65.97 W57/-. Ynysybwl, South Wales. March 1972.
- 1976.65.98 W55/-. Natural Sciences Building, University, Swansea, South Wales. May 1972.
- 1976.65.99 W54/-. Botany Department Annexe, University, Swansea, South Wales. January 1971.
- 1976.65.101 W52/-. Botany Department Annexe, University, Swansea, South Wales. March 1971. This slide displays normal, moulting and simplex individuals.
- 1976.65.102 W41/-. Barafundle Bay, Wales. August 1971.
- 1976.65.104 W39/-. Brecon Beacons, Wales. 925'. Moss on boulders in stream. July 1972.
- 1976.65.105 W38/-. Brecon Beacons, Wales. 1000'. July 1972.
- 1976.65.106 W37/-. Blackpill, Swansea, South Wales. Moss. August 1971.
- 1976.65.107 W36/-. Wyn Ogwen, Snowdon, Wales. 950'. November 1971.
- 1976.65.111 W71/-. Botany Department Annexe Roof, University, Swansea, South Wales. March 1971.
- 1976.65.113 W63/-. Nant Bran, Brecon Beacons, Wales. October 1971.
- 1976.65.114 W64/-. Natural Sciences Buildings, University, Swansea, South Wales. May 1973. Several specimens, some with brown pigmentation.
- 1976.65.115 W73/-. Natural Sciences Building Roof, University, Swansea, South Wales. May 1972.
- 1976.65.118 Sc6/S9. North of Aberfoyle, Trossachs, Scotland. Moss collected from an observation point on the A821.
- 1976.65.119 W86/-. Killay, Swansea, South Wales. Moss. March 1972.
- 1976.65.120 W9/S65. Mewslade, Gower, South Wales. September 1973. One egg.
- 1976.65.121 Sc20/S20. Ben Nevis, Scotland. 4406'. September 1972.
- 1976.65.122 W82/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.123 W62/-. Natural Sciences Building, University, Swansea, South Wales. May 1972.
- 1976.65.124 W94/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.125 W68/-. Botany Department Annexe Roof, University, Swansea, South Wales. April 1973. Several specimens and a number of well preserved eggs.
- 1976.65.126 W93/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.

- 1976.65.129 E37/-. Hungary Hall, Bucks. Granary roof and gutter. December 1971.
- 1976.65.133 W76/-. Swansea, South Wales. Roof moss. May 1971.
- 1976.65.135 W47/-. Cwm Idwal. North Wales. October 1971.
- 1976.65.137 W81/-. Upper Killay, South Wales. Moss. August 1971.
- 1976.65.138 W70/-. Nant Bran, Brecon Beacons, Wales. Bridge near target area. October 1971.
- 1976.65.140 W69/-. Botany Department Annexe Roof, University, Swansea, South Wales. April 1972. Several adults specimens and a single egg with abnormal, squat projections.
- 1976.65.141 E22/-. Bristol, back garden (M.I.). March 1972.
- 1976.65.142 W72/-. Natural Sciences Building Roof, University, Swansea, South Wales. April 1971.
- 1976.65.143 W13/S69. Newslade, Gower, South Wales. August 1973.
- 1976.65.144 E38/-. Near Truro, Cornwall. Moss. May 1972.
- 1976.65.145 W92/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.146 W74/-. Botany Department Annexe Roof, University, Swansea, South Wales. November 1971.
- 1976.65.148 W88/-. Botany Department Annexe, University, Swansea, South Wales. Gutter moss. January 1974.
- 1976.65.150 W75/-. Botany Department Annexe Roof, University, Swansea, South Wales. March 1972.
- 1976.65.151 W91/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.152 Sc29/S37. Lynchat to Kingussie, Scotland. September 1972.

Macrobiotus intermedius Plate, 1888

- 1976.65.43 I9/-. Corlough, Belmullet, Eire. August 1971. A single specimen 145 μm in length. Individuals of this species may attain a length of up to 350 μm . Pharyngeal bulb containing apophysis, three granular macroplacoids of equal length, and a minute microplacoid. The first macroplacoid, when viewed from the ventral surface, is overlaid by the apophysis, a characteristic of the species. The ratio of length to breadth of the pharynx is 1.3:1. The buccal tube bends slightly on entering the bulb. The mouth is sub-terminal as in the genus *Hypsibius*. The cuticle is smooth and hyaline and scattered with small translucent spots. A well preserved example of a rare British species, although *M.intermedius* has a cosmopolitan world distribution.

Macrobiotus islandicus Richters, 1904

- 1976.65.121 Sc20/S20. Ben Nevis, Scotland. 4406'. September 1972. A single specimen with prominent pigment granules on the dorsal surface. The pharyngeal bulb contains two short, broad macroplacoids, the first larger than the second. The lunules at the base of each claw are smooth. *M.islandicus* is restricted in distribution to Northern Europe and the Arctic.

Macrobiotus macronyx Dujardin, 1851

- 1921.144.150 *Macro macronyx and Philodina*. Shaws Quarry. A single specimen of *M. macronyx*: very badly distorted.
- 1921.144.161 *Macro macronyx*. A single specimen, badly distorted but bearing *macronyx* type claws.
- 1921.144.162 *Macrobiotus macronyx*. Marl Pit. Evans. 16.2.1906. No specimen visible.
- 1921.144.163 *Macrobiotus macronyx?* Scotland
- 1921.144.184 *M. macronyx*. Loch Ness. February 1906. (in pencil "2 polaris"). Specimens with *macronyx* type claws; pharyngeal apparatus indistinct. *M. polaris* is an antarctic species (see Murray, 1910), accurate determination of which depends on the presence of eggs.

Macrobiotus occidentalis Murray, 1910

- 1976.65.14 W2/S2. Newtown, Wales. Two specimens, the larger 360 μ m in length with cuticular ornamentation confined to posterior portion of the body.
- 1976.65.48 Sc18/S13. Dunbarton to Inverary, Scotland. Highest point of A83. September 1972. A single specimen, 335 μ m in length, with only faint evidence of the cuticular granulation, well-spaced, elliptical pore-like structures arranged in transverse and longitudinal rows.
- 1976.65.49 Sc9/S14. Rannoch Moor, Scotland. Three specimens, 314 μ m in length. *M. occidentalis* can attain lengths of up to 800 μ m (Ramazzotti, 1972) but British specimens rarely do so.
- 1976.65.52 Sc12/S16. Foot of Ben Nevis, Scotland. September 1972. A single simplex individual, determined on the basis of the cuticular sculpturing.
- 1976.65.57 Sc28/S36. North of Dunrobin Castle, Scotland. September 1972. Three specimens. Note arrangements of placoids in pharyngeal bulb; apophysis; two macroplacoids, both club-shaped with the first longer than the second and bearing a median constriction; microplacoid.
- 1976.65.59 Sc15/S23. Loch Lochy, Scotland. September 1972. Although usually found in terrestrial situations the two specimens of *M. occidentalis* preserved on this slide were extracted from moss, subject to frequent immersion, at the edge of the loch.
- 1976.65.60 Sc16/S29. Dingwall to Bonar Bridge, Scotland. September 1972.
- 1976.65.72 W25/-. Old Forge, Parkmill, South Wales. Moss. August 1971.
- 1976.65.64 W27/-. Pennard, Gower Peninsula, South Wales. June 1972.
- 1976.65.75 W28/-. Llandovery, South Wales. Moss from an old stone bridge in the town centre. September 1972.
- 1976.65.76 W29/-. Llandovery, South Wales. Moss from an old stone bridge in the town centre. December 1971.
- 1976.65.84 W31/-. Newgale Bridge, Wales. Wall moss. January 1972.
- 1976.65.106 W37/-. Blackpill, Swansea, South Wales. Moss. August 1971.
- 1976.65.118 Sc6/S9. Trossachs, Scotland. September 1972. Three specimens all with poorly defined granulation.

Macrobotus orcadensis Murray, 1907

- 1976.65.54 Sc24/S27. Kinlochewe to Achnasheen, Scotland. September 1972. Two specimens each with a pharyngeal bulb containing apophysis and three elongate oval macroplacoids of about equal length, together with a microplacoid.
- 1976.65.55 Sc25/S19. Ben Nevis, Scotland. 4406'. September 1972. Twelve specimens all within the size range 250-300 μ m in length.
- 1976.65.121 Sc20/S20. Ben Nevis, Scotland. 4406'. September 1972. Eleven specimens.

Macrobotus richtersi Murray, 1911

- 1976.65.1 W15/S71. Flatholm, Bristol Channel. August 1973. A large number of adults and eggs. There has been considerable controversy regarding the status of *M. richtersi* and the morphologically similar *M. areolatus* and *M. harmsworthi*. It has been common practice to use the eggs for accurate species determination but recently doubt has been expressed regarding the validity of egg morphology for taxonomic purposes (Hallas, 1972). It is possible to separate the three species using the buccal tube ratio, which refers to the external diameter (μ m) of the buccal tube divided by the length of the buccal tube (μ m). *M. richtersi* displays a buccal tube ratio of 0.167 – 0.2375 (Morgan, 1976). The material on this slide is in an excellent state of preservation for observation of adult and egg morphological features.
- 1976.65.3 W11/S67. Mewslade, Gower, South Wales. August 1973. Several specimens extracted from the orange lichen *Xanthoria*.
- 1976.65.10 E16/S48. Taunton, Somerset. January 1973.
- 1976.65.14 W2/S2. Newtown, Wales.
- 1976.65.16 W17/S72. Flatholm, Bristol Channel. Adult specimens of *M. richtersi*.
- 1976.65.17 E30/-. A436, Chipping Norton to Stow. December 1971.
- 1976.65.20 E40/-. Wall of Botanic Garden, Stow on the Wold, Gloucestershire. December 1971.
- 1976.65.23 E44/-. Stow on the Wold, Gloucestershire. Wall of Botanic Garden. December 1971.
- 1976.65.24 E50/-. Kestor Rock, near Chagford, Dartmoor. Stone parapet. November 1971.
- 1976.65.25 E51/-. Kestor Rock, Fortescue Cairn, near Chagford, Dartmoor. 1350'
- 1976.65.29 Sc32/S43. Oban, Scotland. September 1972. Eight specimens extracted from moss collected around the walls of Dunstaffnage Castle.
- 1976.65.33 I1/-. Carne House, Belmullet, Eire. April 1971. Twenty adult specimens and a single egg. The eggs of *M. richtersi* vary between 70 μ m and 140 μ m in diameter and are covered with projections about 25 μ m in height. There are usually 10-20 projections visible in optical section, each appearing as a roughened, blunt one, with a "crazy paving" areolation of the eggshell visible between them.
- 1976.65.34 I2/-. Carne Banks, Belmullet, Eire. April 1971. Fourteen specimens 210 μ m to 520 μ m in length extracted from moss growing on sandy soil.
- 1976.65.36 I12/-' Belmullet, Eire. August 1971. Thirteen specimens extracted from wall moss. One individual with unusual brown granulation.
- 1976.65.38 E9/S53. Padstow, Cornwall. August 1973.
- 1976.65.39 E10/S58. Porth Hellick, Isles of Scilly. August 1973.
- 1976.65.44 I5/-. Aran Isles, Ireland. (P.K.). September 1971.

- 1976.65.46 I3/-. Carne House, Belmullet, Eire. A single specimen extracted from wall moss.
- 1976.65.53 Sc23/S18. Ben Nevis, Scotland. 4406'. September 1972. Several specimens, the largest 400 μ m in length.
- 1976.65.57 Sc28/S36. North of Dunrobin Castle, Scotland. September 1972.
- 1976.65.63 Sc19/S30. Altnahara, Scotland. September 1972. A single specimen, in moss from the side of a small loch.
- 1976.65.68 J2/S99. Jersey, Mt. Bingham. Emplacement. Moss. Six specimens.
- 1976.65.75 W28/-. Llandovery, Wales. Moss from an old stone bridge in town centre. September 1972.
- 1976.65.77 W30/-. Solva, Wales. Harbour wall. January 1972.
- 1976.65.79 J12/S112. Jersey. L'Ille de Bas. Highwater. Moss. A single specimen in moss from the splashzone of the sea shore, an unusual choice of habitat for a terrestrial tardigrade species.
- 1976.65.84 W31/-. Newgale Bridge, Wales. Wall moss. January 1972.
- 1976.65.86 W34/-. Black Mountains, Nant Bran, Wales. Stream edge, 1200'. October 1971.
- 1976.65.90 W22/-. Summit, Rhossili Down, Wales. December 1971. A dubious determination.
- 1976.65.94 W43/-. Horton, Gower, South Wales. Button moss. August 1971.
- 1976.65.95 W42/-. Parkmill, Gower, South Wales. Moss near stream. August 1971.
- 1976.65.100 W53/-. Parkmill, Gower, South Wales. Moss near stream. August 1971.
- 1976.65.103 W40/-. Stackpole Quay, Wales. Moss. August 1971.
- 1976.65.107 W36/-. Wyn Ogwen, Snowdon, Wales. 950'. November 1971.
- 1976.65.110 W44/-. *Rhacomitrium* sp. Horton, Gower, South Wales. August 1971. *Rhacomitrium* is usually a very poor habitat for tardigrades probably because of its heavily cellulosed cell walls which make penetration by tardigrade stylets very difficult.
- 1976.65.113 W63/-. Nant Bran, Brecon Beacons, Wales. October 1971.
- 1976.65.130 W84/-. Stepside, Wales. April 1972.
- 1976.65.131 W6/S46. Bangor, Wales. (P.J.M.) January 1973
- 1976.65.149 W79/-. Limeslade, Gower Peninsula, South Wales. November 1970. Specimens from orange lichen (*Xanthoria* sp.)

Genus *Hypsibius* Ehrenberg, 1848

Type species: *Hypsibius hemprichii* Ehrenberg, 1848

Subgenus *Calohypsibius* Thulin, 1928

Type species: *Macrobiotus ornatus* Richters, 1900

Hypsibius (Calohypsibius) ornatus (Richters, 1900)

- 1976.65.54 Sc24/S27. Kinlochewe to Achnasheen, Scotland. September 1972. A single specimen, 125 μ m in length and slightly distorted, extracted from roadside moss. *H.(C.) ornatus* has been infrequently recorded at various altitudes throughout the British Isles. This individual is colourless, with eight transverse rows of spines, 8-12 spines per row, in a dorsal and dorsolateral position. The

first row of spines corresponds with the first pair of legs and the last row with the fourth pair. Between these cuticular spines are small, rounded, stud-like papillae which are more abundant in the cephalic region. *H.(C.) ornatus* is a species which displays considerable morphological variability and thirty two varieties have been recognised (Bartos, 1940; Ramazzotti, 1972).

Subgenus *Diphascon* Plate, 1889

Type species: *Diphascon chilense* Plate, 1889

Hypsibius (Diphascon) alpinus (Murray, 1906)

1976.65.53 Sc23/S18. Ben Nevis, Scotland. 4406'. September 1972. Several specimens extracted from moss growing on a cairn at the summit.
Largest individual 226 μ m. Cuticle smooth and hyaline; body long and uniformly narrow, not tapering as in many *Diphascon* species. The buccal tube is narrow (1-2 μ m) and undulates before entering the pharyngeal bulb, the latter containing apophysis, three macroplacoids which increase in length from the first to the third, a microplacoid and septulum.
H. (D.) alpinus is regarded as a cosmopolitan species, yet its British distribution is fragmentary.

1976.65.117 Sc13/S17. Summit of Ben Nevis, Scotland. 4406'. September 1972.
Two very transparent specimens, about 200 μ m in length.

Hypsibius (Diphascon) angustatus (Murray, 1905)

1976.65.26 E53/-. Kestor Rock, near Chagford, Dartmoor. Lichen. November 1971.
A single specimen in which the body progressively tapers from the third pair of legs, the widest part of the animal, towards the cephalic region, giving it a snout-like appearance. Characteristically, the pharyngeal tube is short and wide and the pharyngeal bulb narrow, twice as long as broad, with two slender macroplacoids, the first shorter and about half the length of the second.
British records of *H.(D.) angustatus*, like those of many other *Diphascon* species, are more frequent for altitudes in excess of 1,000 feet.

Hypsibius (Diphascon) scoticus (Murray, 1905)

1973.22.1 Road from Hunkeliseter to Seljostrad, Norway. August 1972. Ten specimens 350 μ m to 400 μ m in length. Extracted from moss collected from the edge of the snowline at an altitude of 1434 metres. One specimen 380 μ m in length with three macroplacoids in pharyngeal bulb, of which the third is longest and the second shortest. Ratio of length to breadth of pharyngeal bulb is 1.75:1 (the ratio is usually 2:1).

1976.65.37 E7/S53. Isle of Man. Pasture land at south end of island. May, 1973.
A single specimen, in moss from an unusual habitat for a member of this genus of Tardigrada.

1976.65.54 Sc24/S27. Kinlochewe to Achnasheen, Scotland. Spetember 1972.
A single specimen, 325 μ m in length. Individuals of this species rarely exceed 400 μ m in length.

1976.65.83 Sc5/S8. Queen Elizabeth Forest Park, Scotland. September 1972.
A single specimen.

1976.65.118 Sc6/S9. Trossachs, Scotland. September 1972. Moss collected from an observation point off the A821, north of Aberfoyle. A single individual, 197 μ m in length.

Hypsibius (Diphascus) spitzbergensis (Richters, 1903)

- 1976.65.128 W49/-. Black Mountains, near Nant Bran, Wales. 1,500'. October 1971. Seven specimens extracted from moss. All display normal *spitzbergensis* characteristics: smooth and hyaline cuticle; body slender and elongate; double claws of each leg robust and different; wide pharyngeal tube (4.0 μm to 6.5 μm); elongate pharyngeal bulb (ratio of length: breadth 2:1); bulb with two slender, rod-like macroplacoids, the first a third to half the length of the second, and a macroplacoid.
Although widely recorded elsewhere throughout Europe, there are few British records of *H. (D.) spitzbergensis*.

Subgenus *Hypsibius* Thulin, 1928

Type species: *Macrobotus Oberhaeuser* Doyère, 1840

Hypsibius (Hypsibius) conjungens Thulin, 1911

- 1976.65;36 I12/-. Carne House, Belmullet, Eire. August 1971. Three specimens extracted from wall moss, collected at the old orchard, Carne House. Largest individual 220 μm in length. Buccal tube narrow, less than 1 μm internal diameter, and with a distinct bend halfway along its length. Characteristic of the species is the length of the buccal tube between the stylet supports and the pharyngeal bulb which may equal or exceed half the length of the bulb. The pharynx is a short oval and contains two granular macroplacoids but no microplacoid. The cuticle is smooth and the body colourless, thin and slender, and with short stumpy legs equipped with small claws of the *Hypsibius* type. This slide also includes a crumpled *Hypsibius* cast with six smooth eggs. The eggs of *H.(H.) conjungens* are laid free and covered with slender, distorted, conical processes (Ramazzotti, 1972). In the absence of any other *Hypsibius* species these eggs were attributed to *H.(H.) conjungens*, which has been known to lay eggs in the cast skin on one previous occasion (Cueñot, 1932). *H.(H.) conjungens* has been recorded on only two occasions from the British Isles (Morgan, 1975 and 1976).

Hypsibius (Hypsibius) dujardini (Doyère, 1840)

- 1976.65.9 E15/-. Bradford, Yorkshire. (M.I.). July 1972. Two specimens in moss from a Bradford roof.
- 1976.65.43 I9/-. Corlough, Belmullet, Co. Mayo, Eire. August 1971. A single specimen measuring 195 μm in length. Pharyngeal bulb a short oval, ratio of length: breadth 1.15:1. Bulb with apophysis and two rod-like macroplacoids, the first longer than the second and bearing a slight median constriction, or "throttling". Microplacoid absent; Ramazzotti (1972) described it as usually present. Although generally considered to be aquatic, *H.(H.) dujardini* does occur in terrestrial situations. The specimen on this slide was extracted from wall moss.
- 1976.65.53 Sc23/S18. Ben Nevis, Scotland. 4406'. September 1972. A single specimen 275 μm in length *H.(H.) dujardini* may attain lengths of up to 500 μm .
- 1976.65.69 J3/S101. Jersey, Highlands College, St. Samsons. Moss. A single specimen, 297 μm in length.
- 1976.65.91 W23/-. Parkmill Lane, Swansea, South Wales. Moss.

Hypsibius (Hypsibius) oberhaeuseri (Doyère, 1840)

- 1973.22.4 Cafer Kule, near Mergan, Turkey. 1971. Several specimens extracted from moss collected off rock surfaces at 2,400 metres.

- 1976.65.3 W11/S67. In *Xanthoria* sp. Mewsdale, Gower, South Wales. August 1973
H.(H.) oberhaeuseri is a common inhabitant of encrusting lichens, particularly the orange/yellow *Xanthoria* sp.
- 1976.65.6 W5/-. Pennard, Gower, South Wales (lichen). August 1972. Several adult specimens plus eggs, which are spherical, 45 μ m-65 μ m in diameter, laid free, and covered with low hemispherical projections or truncated cones. Occasionally *H.(H.) oberhaeuseri* may lay smooth eggs in the moulted cuticle, which raises doubts about the status of the morphologically similar *H.(H.) novemcinctus* which also lays smooth eggs in moulted cuticle. (See Baumann, 1966 for a full discussion of egg laying in *oberhaeuseri* and *novemcinctus*).
- 1976.65.7 E13/S63. Darriti's Hole, Isles of Scilly. August 1973.
- 1976.65.8 E14/S63. Darriti's Hole, Isles of Scilly. August 1973.
- 1976.65.9 E15/-. Bradford, Yorkshire (M.I.). July 1972.
- 1976.65.12 E27/-. Hungary Hall, Bucks. December 1971. Several well preserved specimens displaying typical *oberhaeuseri* characteristics: brown pigmentation arranged in nine transverse and five longitudinal bands (rather faded by mounting medium); cuticle finely but densely granulate (oil immersion required to observe this feature); pharyngeal bulb with two quadrangular macropiloids; external double claw of each leg with a long, slender principal arm and much shorter, strongly curved, secondary arm.
- 1976.65.15 W18/S73. Flatholm, Bristol Channel. August 1973.
- 1976.65.18 E32/-. Hungary Hall, Bucks. November 1971. *Xanthoria* sp.
H.(H.) oberhaeuseri is frequently found in association with *Milnesium tardigradum* Doyère, the other tardigrade species on the slide.
 Together with *E.(E.) testudo* the three species are the commonest found in *Xanthoria* sp.
- 1976.65.19 E33/-. Watersmeet, Lynmouth, Devon. November 1971. Specimens extracted from liverworts encrusting rock overhangs in the river gorge.
- 1976.65.20 E40/-. Wall of Botanic Garden, Stow on the Wold, Gloucestershire.
 December 1971.
- 1976.65.28 E57/-. Hungary Hall, near Olney, N. Bucks. December 1971. Ruined farm alongside disused railway.
- 1976.65.32 Sc37/-. Ben Eighe, Scotland. 1250'. March 1973.
- 1976.65.54 Sc24/S27. Kinlochewe to Achnasheen, Scotland. September 1972.
 Two specimens present on a slide with an incredible species assemblage, unusual for British locations.
- 1976.65.61 Sc17/S31. Bettyhill, Scotland. September 1972. Twenty three specimens showing great variability in the extent of pigmentation including some with posteriorly placed brown pigment granules.
- 1976.65.67 J1/S97. Jersey. St Brelade Churchyard. Moss. A single specimen 220 μ m in length, with distinct cuticular granulation but lacking all pigmentation.
- 1976.65.70 J6/S105. Jersey. La Paleute. Lichen. April 1974. Nineteen specimens, 189 μ m to 324 μ m in length, again associated with *Miln. tardigradum* but in the holdfasts of the grey lichen *Ramalina*, a most unusual choice of habitat (See Morgan, in press).
- 1976.65.71 J9/S109. Jersey. La Paleute, orange lichen. April 1974. Eleven adult specimens, several with black (or intense brown?) granulation.
 A single egg present.
- 1976.65.74 W27/-. Pennard, Gower Peninsula, South Wales. June 1972.
Xanthoria sp.

- 1976.65.78 J11/S111. Jersey. High water, Verclût Point. April 1974. Twenty two specimens extracted from holdfasts of the grey lichen. *Ramalina* collected in the splash zone of the sea shore.
- 1976.65.88 W4/S46. Bangor, North Wales. January 1973.
- 1976.65.98 W55/-. Natural Sciences Building, University, Swansea, South Wales. May 1972.
- 1976.65.102 W41/-. Barafundle Bay, Wales. August 1971. *Xanthoria* sp.
- 1976.65.115 W73/-. Natural Sciences Building Roof, University, Swansea, South Wales. May 1972.
- 1976.65.119 W86/-. Moss. Killay, Swansea, South Wales. March 1972. Apart from normal adult individuals this slide also contains an *oberhaeuseri* cast with thirteen eggs.
- 1976.65.122 W82/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.124 W94/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.125 W68/-. Botany Department Annexe roof, University, Swansea, South Wales. April 1973. Some adult *oberhaeuseri* with unusual pigmentation.
- 1976.65.126 W93/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.129 E37/-. Hungary Hall, Bucks. Granary roof and gutter. December 1971.
- 1976.65.133 W76/-. Roof moss, Swansea, South Wales. May 1971.
- 1976.65.134 W80/-. Physics Tower, Swansea, South Wales. January 1971.
- 1976.65.135 W47/-. Cwm Idwal, North Wales. October 1971.
- 1976.65.136 W65/-. Garage, Pennard, Gower, South Wales. Moss P.K. Unpigmented individuals. The characteristic cuticular granulation is clearly visible.
- 1976.65.145 W92/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.150 W75/-. Botany Department Annexe roof, University, Swansea, South Wales. March 1972.
- 1976.65.151 W91/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.152 Sc29/S37. Lynchat to Kingussie, Scotland. September 1972.

Hypsibius (Hypsibius) zetlandicus (Murray, 1907)

- 1921.144.62 *M.zetlandicus* 29.11.1906. This single specimen has obviously been stained, a difficult and time consuming process with Tardigrada. Eye spots, musculature, and pedal ganglia clearly visible. The placoids of the pharyngeal bulb are characteristically lobed. The bulb appears to be of much larger dimensions than that figured by Marcus (1936). The claws are robust and of the *Hypsibius* type.
- 1921.144.158 *Macro.* sp. Crucicornis Pool. April 1906. (in pencil "*zetlandicus*"). Specimen with lobed macroplacoids, confirms Murray's original determination.

Hypsibius (Isohypsibius) annulatus (Murray, 1905)

- 1921.144.63 *M. annulatus* Crucicornis Pool. 2 ex with eggs. Two adults and two moulted skins with eggs. Pharyngeal bulb with long slender macroplacoids (length about X5 width). Each macroplacoid with what appears to be a median constriction. The claws are strongly curved and quite robust, certainly not as slender as those depicted by Ramazzotti (1962). The papillose cuticle is clearly visible, particularly on the moulted skins.
- 1921.144.64 *M. annulatus* Crucicornis Pool. 2 ex with eggs. The two moulted skins contain four eggs.
- 1921.144.152 *M. annulatus* and *M. oberhaeuseri* Crucicornis Pool, FA April 1906. Very good specimen of *H. (I.) annulatus*, although the pharyngeal structure is rather faint. The second specimen on this slide is not *H.(H.) oberhaeuseri* and poor definition of important taxonomic feature makes positive identification impossible.
- 1921.1.144.155 *Macrobiotus annulatus*. Carrying eggs. Fort Augustus, Scotland. April 1906. A single specimen with four eggs.
- 1921.144.156 *Macro. annulatus*. Crucicornis Pool. April 1906. This single specimen of *H. (I.) annulatus* is slightly contracted but otherwise clearly displays the cuticular and pharyngeal characteristics of the species.
- 1921.144.157 *Macrobiotus*. Eggs in skin. Geneva, Switzerland. There are four specimens on this slide, one of which is in a very good state of preservation and corresponds to *H.(I.) annulatus*. A.E.Le Gros examined this material in 1956 and considered all the specimens as possibly being *M. ambiguus*.
- 1921.144.159 *Macrobiotus annulatus*. Crucicornis Pool. April 1906. A very poor specimen.
- 1921.144.176 *Macrobiotus*. Fort Augustus. November 1904. Two empty skins attributed to *H. (I.) annulatus* on the basis of cuticular sculpturing and claws. Other specimens on slide unrecognisable.

Hypsibius (Isohypsibius) augusti (Murray, 1907)

- 1921.144.153 Large *Macrobiotus*. Crucicornis Pool. April 1906. (In pencil "*augusti*"). One good specimen with well defined claws but indistinct placoids.
- 1921.144.154 *Macro. augusti*. Fort Augustus, Scotland. November 1906. A very good specimen of *H.(I.) augusti* with all important diagnostic features visible.
- 1921.144.170 *Macro. augusti*. Fort Augustus, Scotland. November 1906. A number of badly distorted specimens together with a single individual suitable for taxonomic purposes.
- 1921.144.172 *Macro. augusti*. Fort Augustus. November 1906. Two specimens the larger with elongate placoids and prominent peribuccal lamellae.
- 1921.144.173 *Macro. augusti*. Fort Augustus, Scotland. November 1906. About twenty specimens all stained (?) brown and slightly distorted.
- 1921.144.181 *Macrobiotus augusti*. Crucicornis Pool. April, 1906
- 1921.144.183 *Macrobiotus*. Crucicornis Pool. April 1906. (In pencil "*Augusti???*"). Specimen not in adequate state of preservation to allow accurate redetermination.

Hypsibius (Isohypsibius) papillifer (Murray, 1905)

- 1921.144.149 *M.papillifer*. Loch Ness, Scotland. April 1906. The characteristic cuticular papillae of the dorsal and lateral surfaces are barely visible on this single specimen of *H.(I.) papillifer*. The claws, where they can be seen, are of the *Isohypsibius* type.

Subgenus *Isohypsibius* Thulin, 1928

Type species: *Isohypsibius prosotomus* Thulin, 1928

Hypsibius (Isohypsibius) prosotomus Thulin, 1928

- 1975.52.4 W67/-. Penrice Towers, Gower, South Wales. (A.O.) Roadside moss. Two specimens, the largest 390 μ m in length. The characteristic chitinous bar on each side of the first three pairs of legs 11.5 μ m to 15 μ m in length.
- 1975.52.5 Sc34/S12. Loch Lomond, Scotland. Moss. September 1972. Several specimens extracted from moss subject to immersion at the edge of the loch. *H.(I.) prosotomus* is widely distributed but occurs infrequently in aquatic situations.
- 1976.65.4 W10/S66. Port Eynon, Gower, South Wales. August 1973. Several specimens, including casts containing smooth, oval eggs.
- 1976.65.9 E15/-. Bradford, Yorkshire. (M.I.). July 1972.
- 1976.65.13 W3/-. Newtown, Wales. October 1970. Two specimens about 350 μ m in length.
- 1976.65.14 W2/S2. Newtown, Wales.
- 1976.65.16 W17/S72. Flatholm, Bristol Channel. August 1973.
- 1976.65.17 E30/-. A436. Chipping Norton to Stow. December 1971.
- 1976.65.42 I6/-. Carne House, Belmullet, Eire. Wall and trees. April 1971. Five specimens, 220 μ m to 325 μ m in length. (*H.(I.) prosotomus* can attain a length of up to 470 μ m).
- 1976.65.46 I3/-. Carne House, Belmullet, Eire. A single specimen 252 μ m in length, extracted from moss growing on walls and trees.
- 1976.65.58 Sc30/S38. Dalkeith, Scotland. September 1972. A single specimen 350 μ m in length. A dubious determination.
- 1976.65.79 J12/S112. Jersey. L'Ile de Bas. High water. Moss. April 1974. Seven specimens, 200 μ m to 270 μ m in length.
- 1976.65.91 W23/-. Parkmill Lane, Swansea, South Wales. Moss.
- 1976.65.144 E38/-. Near Truro, Cornwall. Moss. May 1972.

Hypsibius (Isohypsibius) prosotomus Thulin, 1928. var. *cambrensis* Morgan, 1976

- 1975.52.1 J10/S110. Verclût Point, Jersey. High water. April 1974. Twelve specimens, up to 270 μ m in length, and a cast containing six eggs. The cuticle of *H.(I.) prosotomus* var. *cambrensis* is covered with a fine, regular granulation which is observed using oil immersion. In addition, the hypodermis may be speckled with irregularly shaped, brown pigment granules, often arranged in two dorsal longitudinal rows as well as occurring on the head and flanks.
- 1975.52.2 W7/-. Bangor, North Wales (P.J.M.) Moss. June 1973. A single specimen, 211 μ m in length, with very faint dorsal pigmentation.
- 1975.52.3 W78/-. North wall of Microbiology Department, Swansea, South Wales. November 1970. A single specimen (holotype), 240 μ m in length, with very faint granulation but very prominent pigmentation.

- 1975.52.4 W67/-. Penrice Towers, Gower, South Wales. (A.O.). Roadside moss. A single specimen.
- 1975.52.5 Sc34/S12. Loch Lomond, Scotland. Moss. September 1972. A single specimen extracted from moss subject to infrequent immersion at the edge of the loch.
- 1976.65.46 I3/-. Carne House, Belmullet, Eire. A single specimen 330 μ m in length in wall moss.

Hypsibius (Isohypsibius) schaudinni (Richters, 1909)

- 1976.65.5 W8/S64. Port Eynon, Gower, South Wales. September 1973.
H.(I.) schaudinni, is very similar to *H.(I.) prosostomus* and Cuénot (1932) maintained that the two species should be united. *H.(I.) schaudinni*, however, is characterized by having a subterminal mouth; a minute microplacoid (often missing); macroplacoids which increase in length from one to three; no chitinous bar at the base of the minor double claw on each end of the first three pair of legs.
- 1976.65.46 I3/-. Carne House, Belmullet, Eire. A single specimen 260 μ m in length in wall moss.
- 1976.65.57 Sc28/S36. North of Dunrobin Castle, Scotland. September 1972. Three specimens.
- 1976.65.87. W32/-. Haverfordwest, Barn St., Wales. Wall moss. January 1972. Five specimens.

Family Milnesiidae Ramazzotti, 1962

Genus *Milnesium* Doyère, 1840

Type species: *Milnesium tardigradum* Doyère, 1840

Milnesium tardigradum Doyère, 1840

- 1973.22.2 Swansea, South Wales. *Bryum* sp. January 1972
- 1976.65.18 E32/-. Hungary Hall, Bucks. *Xanthoria* sp. November 1971.
Milm. tardigradum is frequently found in yellow lichen in association with *H.(H.) oberhaeuseri*.
- 1976.65.35 E3/S47. Portsmouth, Hants. January 1973.
- 1976.65.40 E12/S62. Isles of Scilly. August 1973. *Milm. tardigradum* is carnivorous, feeding on rotifers, nematodes and other tardigrades. Usually it occurs with large populations of other tardigrade species.
- 1976.65.49 Sc9/S14. Rannoch Moor, Scotland. Two specimens.
- 1976.65.52 Sc12/S16. Foot of Ben Nevis, Scotland. September 1972. Several specimens the largest 610 μ m in length. Females of this species may attain a length of 1,000 μ m or more, while males rarely exceed 500 μ m.
- 1976.65.54 Sc24/S27. Kinlochewe to Achnasheen, Scotland. September 1972.
Ten specimens, some clearly illustrating the characteristic fish-like appearance of the animals when viewed from the dorsal surface.
- 1976.65.55 Sc25/S19. Ben Nevis, Scotland. 4406'. September 1972.
Milm. tardigradum is cosmopolitan in distribution with a wide altitudinal range.
- 1976.65.56 Sc25/S34. Junction of A836 and A897 near Melvich, Scotland. September 1972. Fifteen specimens. The pear-shaped pharyngeal bulb, completely devoid of placoids, and the unique claw complement are readily visible.

- 1976.65.60 Sc16/S29. Dingwall to Bonar Bridge, Scotland. September 1972.
- 1976.65.70 J6/S105. Jersey. La Paleute. Lichen. April 1974. Two specimens extracted from the holdfasts of the grey lichen *Ramalina* sp.
- 1976.65.73 W26/-. Natural Sciences Building, University, Swansea, South Wales. Moss. In addition to normal adult individuals there is a cast with eggs, and a few juveniles. Up to 18 eggs may be deposited at any one time but six to eight is more usual.
- 1976.65.75 W28/-. Llandoverly, Wales. Moss from an old stone bridge in town Centre. September 1972.
- 1976.65.76 W29/-. Carmarthen, Wales. December 1971. Moss from the walls of electricity installations on the A40, west of Carmarthen.
- 1976.65.78 J11/S111. Jersey. High Water. Verclût Point. April 1974. Four specimens in the holdfast of the grey lichen *Ramalina* sp.
- 1976.65.82 Sc4/S5. Bargrennan to Straiton, Scotland. 1407'. September 1972. Three specimens.
- 1976.65.89 W21/-. Carmarthen to St. Clears Rd., Wales. December 1971.
- 1976.65.97 W57/-. Ynysybwl, South Wales. March 1972.
- 1976.65.112 W89/-. University College Swansea, South Wales. January 1973. Several large individuals plus casts with eggs. *Miln. tardigradum* is usually colourless, but occasionally pigmented with red or brown, which may be spread evenly over the whole or greater part of the body; arranged in three broad longitudinal bands; restricted to large, irregular granules. Pigmentation is slowly leached from slide preparations by the mounting medium A.C.S.
- 1976.65.116 W61/-. Horton, Gower, South Wales. September 1971.
- 1976.65.119 W86/-. Moss. Killay, Swansea, South Wales. March 1972.
- 1976.65.122 W82/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
- 1976.65.125 W68/-. Botany Department Annexe Roof, University, Swansea, South Wales. April 1973.
- 1976.65.133 W76/-. Roof moss, Swansea, South Wales. May 1971.
- 1976.65.135 W47/-. Cwm Idwal, North Wales. October 1971.
- 1976.65.147 W20/S75. Botany Department Annexe, University, Swansea, South Wales. September 1973.
- 1976.65.150 W75/-. Botany Department Annexe Roof, University, Swansea, South Wales. March 1972.
- 1976.65.151 W91/-. Natural Sciences Building, University, Swansea, South Wales. March 1972.
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 kerguelensis, Echiniscus (Echiniscus) 2

 Macrobiotidae 7
 Macrobiotus 7
 macronyx, Macrobiotus 13
 merokensis, Echiniscus (Echiniscus) 2
 Milnesiidae 22
 Milnesium 22
 mirus, Batillipes 1
 mutabilis, Echiniscus 7

novemcinctus, Hypsibius (Hypsibius) 18
 Oberhaeuser, Macrobiotus 17
 oberhaeuseri, Hypsibius (Hypsibius) 17
 occidentalis, Macrobiotus 13
 orcadensis, Macrobiotus 14
 ornatus, Hypsibius (Calohypsibius) 15
 ornatus, Macrobiotus 15
 papillifer, Hypsibius (Isohypsibius) 21
 papillifer, Macrobiotus 21
 parvulus, Bryodelphax 1
 parvulus, Echiniscus (Bryodelphax) 1
 prosotomus, Hypsibius (Isohypsibius) 21
 prosostomus, Isohypsibius 21
 Pseudechiniscus 7
 quadrifilis, Echiniscus (Echiniscus)
 testudo var. 3
 quadrispinosus, Echiniscus (Echiniscus) 3
 reticulatus, Echiniscus (Echiniscus) 3
 richtersi, Macrobiotus 7, 14
 schaudinni, Hypsibius (Isohypsibius) 22
 scoticus, Hypsibius (Diphascion) 16
 spinulosus, Echiniscus (Echiniscus) 3
 spitsbergensis, Echiniscus (Echiniscus) 3
 spitzbergensis, Hypsibius (Diphascion) 17
 suecicus, Echiniscus (Echiniscus)
 merokensis var. 2
 suillus, Echiniscus 7
 suillus, Pseudechiniscus 7
 tardigradum, Milnesium 18, 22
 testudo, Echiniscus (Echiniscus) 3, 8
 trifilis, Echiniscus (Echiniscus) testudo
 var. 3
 trisetosus, Echiniscus (Echiniscus) 5
 wendti, Echiniscus (Echiniscus) 2, 6
 zetlandicus, Hypsibius (Hypsibius) 19

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