AUSTRALASIAN ANTARCTIC EXPEDITION
1911-14.
UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, O.B.E., B.E., D.Sc., F.R.S.

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SERIES C.—ZOOLOGY AND BOTANY.

Edited by Professor T. Harvey Johnston,
University of Adelaide.

VOL. X PART 4.

CESTODA

BY

PROFESSOR T. HARVEY JOHNSTON,
UNIVERSITY OF ADELAIDE.

WITH NINETY-ONE TEXT FIGURES.

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THE CESTODA

OF THE

AUSTRALASIAN ANTARCTIC EXPEDITION.

By T. Harvey Johnston, Professor of Zoology, University of Adelaide.

(With ninety-one text figures.)

HISTORICAL.

The first cestodes known from the Antarctic appear to have been brought back from the Ross Sea by Sir James Clark Ross in the "Erebus" and "Terror" (1841–4), viz., those subsequently described by Baird (1853) as *Taenia zederi* and *Bothriocephalus antarcticus* from the emperor penguin and Ross seal respectively. In 1874 the "Challenger" collected *Tetrabothrium auriculatum* Linstow (1888) from an Antarctic petrel, *Thalassoica antarctica* from a locality south of 60° S. and between 80° and 100° E., the same species of parasite having been taken, in addition, from a Cape pigeon, *Daption capense*, between Tristan da Cunha and Capetown (October, 1873). The "Southern Cross" (1898–9) brought back from Cape Adare from the Ross seal, a tapeworm which Linstow (1902) reported to be *Bothriocephalus tectus*, a species which he had previously (1892) described from a sea elephant from South Georgia. The "Valdivia" (1898), under Chun, spent some time in antarctic and subantarctic waters and collected some cestodes from birds, but these were not reported on until comparatively recently by Szpotanska (1917; 1925; 1929), though some of them were referred to by Clausen (1915) and by Fuhrmann (1921). Unfortunately neither localities nor dates are quoted for the "Valdivia" parasites in most cases.

The British National Antarctic Expedition in the "Discovery," led by Scott (1901-1903), brought back a small collection from the Ross seal, Shipley (1907) describing two new species in addition to that originally described by Baird. At the same time the German Antarctic Expedition in the "Gauss" (1901–3), under Drygalski, succeeded in obtaining the largest collection of cestoda brought back, up to that date, from southern regions, the material being taken in the pack ice off Gaussberg and in Kerguelen and other subantarctic localities. This collection was not reported on till 1921. This report by Professor V. Fuhrmann is by far the most important account of the cestodes of the far South, since its distinguished author, who is the greatest living authority on the group and especially on those infesting birds, re-examined type material of many of the other collections, *e.g.*, "Discovery," "Scotia," and "Pourquoi-pas."

Whilst the "Discovery" and "Gauss" were investigating different regions of Antarctica, the Scottish National Expedition in the "Scotia," under Bruce (1902–3), was engaged in the American quadrant (Weddell Sea and the South Orkneys), its cestodes being reported on by Rennie and Reid (1912). The collection made by the Second French Antarctic Expedition in the "Pourquoi-pas," under Charcot (1908), was described by Railliet and Henry (1912), but unfortunately the report was not accompanied by any illustrations. Scott's second expedition (1910–1913), this time in the "Terra Nova," brought back a large collection, but much of it was taken in regions outside the Antarctic and Subantarctic. This very large assemblage was dealt with by Leiper and Atkinson (1914; 1915), the latter being a member of the Expedition and one whose fine work in discovering the remains of Captain Scott and his ill-fated comrades, deserves great credit.

No reports on Cestoda, if any were collected, from the Belgian (Gerlache, 1897), Swedish (Nordenskiold, 1901), First French (Charcot, 1903), or Shackleton (1907) Antarctic Expeditions have appeared. Some tapeworms have been described from subantarctic regions, *e.g.*, South Georgia, South Shetlands, and Tierra del Fuego, by Linstow, Lonnberg, Nybelin and Baylis.

The Australasian Antarctic Expedition led by my colleague, Professor Sir Douglas Mawson, in the "Aurora" (1911–1914), brought back a large collection of cestodes from the Antarctic (King George V Land, Adelie Land and Queen Mary Land) obtained by Dr. J. E. Hunter, the late C. T. Harrisson and the late Dr. A. L. McLean, and from Macquarie Island by H. Hamilton. The material was contained in 41 jars or tubes and most of it came from Weddell seals. Two larval cestodes were obtained by the late E. R. Waite during his examination of the fish obtained by the expedition—one each from *Notothenia coriiceps* and *Trematomus hansoni*.

LIST OF HOST-SPECIES REPRESENTED IN THE COLLECTION

1.	Weddell seal, *Leptonychotes weddelli* Lesson	14 collections.
2.	Ross seal, *Ommatophoca rossi* Gray	1 ,,
3.	Sea leopard, *Hydrurga leptonyx* Blainville	5 ,,
4.	Sea elephant, *Mirounga leoninus* Linn	3 ,,
5.	Emperor penguin, *Aptenodytes forsteri* Gray	6 ,,
6.	Adelie penguin, *Pygoscelis adeliae* Hornbr. and Jacq.	1 ,,
7.	Antarctic skua, *Catharacta maccormicki* Saunders*	2 ,,

* This is the true Antarctic skua, whereas the bird known as *Megalestris* (i.e., *Catharacta*) *antarctica* Lesson (including *C. lonnbergi*) does not reach the pack ice, its range extending northwards from the South Orkneys, South Georgia and other subantarctic islands into temperate coastal waters. The specific name *antarctica* has been applied very carelessly to various animals, e.g., ***Acanthophis antarctica***, the Australian death-adder, and *Physaloptera antarctica*, its nematode parasite (South Australia); ***Mustelus antarcticus***, a common dog-fish of New Zealand and Southern Australia, and *Terranova antarctica*, a nematode parasite of the last-named, from Southern New Zealand; *Callorhynchus antarcticus*, the elephant fish (a chimaeroid) of South Africa and a name often given to the Southern Australian species *C. milii*; ***Sciaena antarctica***, the jew fish of the Australian coasts, and *Phoca* (i.e., *Arctocephalus*) *antarcticus*, the South African seal. Fuhrmann has applied it to two cestodes, ***Taenia antarctica***, taken from a sledging dog belonging to the "Gauss" Expedition, but originally from Asia; and to ***Tetrabothrius antarcticus***, a parasite of a Wandering Albatross caught in the South Atlantic between Capetown and Tristan da Cunha.

8. Dominican gull, *Larus dominicanus* Licht ... ... 1 collection.
9. Antarctic petrel, *Thalassoica antarctica* Gmelin ... ... 5 ,,
10. Snow petrel, *Pagodroma nivea* Gmelin ... ... 1 ,,
11. Giant petrel (Nelly), *Macronectes giganteus* Gmelin ... ... 1 ,,
12. Large shark, *Somniosus* sp. Waite ... ... 1 ,,
13. Antarctic fish, *Notothenia coriiceps* Richardson ... ... 1 ,,
14. Antarctic fish, *Trematomus hansoni* Boulenger ... ... 1 ,,

One of the bottles containing five tubes, four of them from the Antarctic petrel and one from *Larus dominicanus*, was damaged and had allowed the preservative to evaporate. Numbers 1, 2, 3, 5, 6, 7, 9, 10, 11, 13 were collected in the Antarctic, most of them in the vicinity of Commonwealth Bay; and numbers 3, 4, 8, 12 from Macquarie Island. Host No. 3, the sea leopard, was the only one represented in both collections.

The most notable omissions from the "Aurora" collection are the parasites of the subantarctic skua (*Catharacta antarctica*); the various albatrosses, some of which range south of the pack-ice during summer and some of which breed on Macquarie Island; petrels of various kinds, none being represented in the Macquarie Island material—in fact, the bird-life of that island is entirely unrepresented amongst the cestode host-list, except for the black-backed gull. Apart from birds taken on the Antarctic coast, truly oceanic birds are quite unrepresented in the list of hosts.

The collection contains representatives of three of the orders of Cestoda—Pseudophyllidea, Tetraphyllidea and Cyclophyllidea, the first-named being richly represented by species and individuals from the various kinds of antarctic and subantarctic seals. The chief features of *Diphyllobothrium* spp. from these pinnipedes have been tabulated by Baer (1925) and by Meggitt (1924).

THE SPECIES OF CESTODA OBTAINED BY THE EXPEDITION.

The following is a list of the species contained in the "Aurora" collection:—

PSEUDOPHYLLIDEA.

DIPHYLLOBOTHRIIDAE—

1. *Diphyllobothrium lashleyi* (Leiper and Atkinson).
2. *Diphyllobothrium mobile* (Rennie and Reid).
3. *Diphyllobothrium perfoliatum* Railliet and Henry.
4. *Diphyllobothrium quadratum* (Linstow).
5. *Diphyllobothrium scoticum* (Rennie and Reid).
6. *Diphyllobothrium rufum* Leiper and Atkinson.
7. *Diphyllobothrium scotti* (Shipley).
8. *Diphyllobothrium tectum* (Linstow).
9. *Diphyllobothrium wilsoni* (Shipley).
10. *Diphyllobothrium* sp. (plerocercoid from fishes).
11. *Glandicephalus antarcticus* (Baird).

TETRAPHYLLIDEA.

PHYLLOBOTHRIIDAE—

12. *Phyllobothrium* sp. (larva from sea elephant).
13. *Monorygma macquariae* n. sp.

CYCLOPHYLLIDEA.

TETRABOTHRIIDAE—

14. *Tetrabothrius minutus* Szpotanska.
15. *Tetrabothrius mawsoni* n. sp.
16. *Tetrabothrius magnus* Szpotanska.
17. *Tetrabothrius heteroclitus* Dies.
18. *Tetrabothrius wrighti* Leiper and Atkinson.
19. *Chaetophallus umbrella* (Fuhrmann).

DILEPIDIDAE—

20. *Parorchites zederi* (Baird).

HYMENOLEPIDIDAE—

21. *Aploparaksis larina* Fuhrmann.

Opportunity is also taken to make remarks on the following species not included in the Expedition's material:—

Anomotaenia antarctica Fuhrmann.
Paricterotaenia dominicana Railliet and Henry.
Taenia antarctica Fuhrmann.
Taenia diaphoracantha Fuhrmann.
Taenia diaphana Fuhrmann.
Taenia magellanica Monticelli.

The collection made by the Expedition, including the type material of the new species, is now housed in Australian Museum, Sydney.

LIST OF HOSTS AND CESTODE PARASITES COLLECTED BY THE AUSTRALASIAN ANTARCTIC EXPEDITION.

MAMMALS.

1. *Leptonychotes weddelli* (syn. *Leptonyx weddelli*; *Ogmorhinus weddelli*). The Weddell seal.
   1. *Diphyllobothrium perfoliatum* Railliet and Henry.
   2. *Diphyllobothrium lashleyi* (Leiper and Atkinson).
   3. *Diphyllobothrium wilsoni* (Shipley).
   4. *Diphyllobothrium rufum* Leiper and Atkinson.
   5. *Diphyllobothrium mobile* (Rennie and Reid).

2. *Hydrurga leptonyx* (syn. *Ogmorhinus leptonyx; Stenorhynchus leptonyx*). The sea leopard or leopard seal.
   1. *Diphyllobothrium quadratum* (Linstow).
   2. *Diphyllobothrium scoticum* (Rennie and Reid).
3. *Ommatophoca rossi.* Ross seal.
   1. *Glandicephalus antarcticus* (Baird).
   2. *Diphyllobothrium scotti* (Shipley).
   3. *Diphyllobothrium wilsoni* (Shipley).
   4. *Diphyllobothrium mobile* (Rennie and Reid).
4. *Mirounga leonina* (syn. *Macrorhinus proboscideus*; *Macrorhinus leoninus*; *Cystophora proboscidea*; *Morunga proboscidea*; *M. elephantina*; *M. patagonica*). The sea elephant or elephant seal.
   1. *Diphyllobothrium tectum* (Linstow).
   2. *Phyllobothrium* sp. (larva), near *P. thridax* Ben. and *P. unilaterale* Southwell.

BIRDS.

5. *Aptenodytes forsteri.* Emperor penguin.
   Parorchites zederi (Baird).
6. *Pygoscelis adeliae.* Adelie penguin.
   Tetrabothrius wrighti Leiper and Atkinson.
7. *Larus dominicanus.* Dominican gull.
   Aploparaksis larina Fuhrmann.
8. *Catharacta maccormicki* (syn. *Megalestris maccormicki*). MacCormick's skua.
   Tetrabothrius mawsoni n. sp.
9. *Thalassoica antarctica* (syn. *Procellaria antarctica*). Antarctic petrel.
   Tetrabothrius minutus Szpotanska.
   Tetrabothrius magnus Szpotanska.
   Chaetophallus umbrella (Fuhrmann).
10. *Pagodroma nivea.* Snow petrel.
    Tetrabothrius heteroclitus Dies.
11. *Macronectes giganteus* (syn. *Ossifraga gigantea*). Giant petrel.
    Chaetophallus umbrella (Fuhrmann).

FISH.

12. *Somniosus* sp. A sleeper shark.
    Monorygma macquariae n. sp.
13. *Notothenia coriiceps.*
    Diphyllobothrium sp. (plerocercoid).
14. *Trematomus hansoni.*
    Diphyllobothrium sp. (plerocercoid).

DIPHYLLOBOTHRIIDAE.

DIPHYLLOBOTHRIUM LASHLEYI (*Leiper and Atkinson*) *Meggitt.*

(Figs. 1–8.)

Synonymy—Dibothriocephalus lashleyi Leiper and Atkinson, 1914, 224; 1915, 41–2, pl. 5, figs. 40, 41.

Diphyllobothrium lashleyi Meggitt, 1924, 112.

This small cestode was found in some of the collections from Weddell seals in the vicinity of Commonwealth Bay. It was originally described from material taken by the "Terra Nova" from the same host species in the Ross Sea region. The original description is inadequate and in some respects incorrect, assuming that the two collections contain the same species.

The longest specimen is 22 mm. with a maximum breadth of 1·6 mm. occurring at the junction of the anterior and middle thirds of the strobila, the posterior region narrowing a little. In some very narrow strobilae the more posteriorly situated segments are very narrow and greatly elongate, being four or five times as long as broad, whereas in the more normal strobilae terminal segments are two to three times as long as wide. Young proglottids, except the first few, are more or less quadrate, but soon becoming more elongate as already stated. There is no overlap and the edge of the strobila is only slightly indented at the junction of segments. In the narrower strobilae, the segments are markedly rugose, due no doubt to abnormal contraction. Musculature is poorly developed and the proglottids are very thin.

The scolex seems to have been misinterpreted in the original account and the specimen figured is obviously that of a contracted head viewed laterally. The bothria are long, narrow and slit-like, and overlap little, if at all, and are, of course, situated on the dorsal and ventral surfaces. In some contracted specimens the anterior portion may project slightly (fig. 2) as two nipple-like projections. The bothria measure 0·9 to 1·1 mm. in their uncontracted state, and the scolex 0·4 to 0·64 mm. across; but in another specimen (fig. 2), viewed laterally, the diameter is 0·8 mm. though the bothria are about the same length as in the preceding case. There is practically no neck as segmentation begins 0·1 to 0·3 (at times up to 0·7) mm. behind the end of the suckers.

The unsegmented region is usually about as broad as the scolex, but may be slightly narrower. The strobila widens rapidly as segmentation becomes established, the earliest proglottids being not quite rectangular, but rather wider posteriorly and projecting laterally. The first segments measure about 0·5 mm. broad by 0·25 mm. long. In a strobila consisting of narrower segments which were obviously rugose, due to being rather strongly contracted, the first segment measures 0·46 mm. broad by 0·33 mm. long, the ratio being approximately 4 : 3; rudiments of testes are just visible in a segment 1·1 mm. long by 0·79 mm. broad anteriorly, and 0·97 mm. posteriorly; the first egg-bearing proglottis is 1·21 mm. long by 0·99 mm. broad; the next, 1·54 mm. long by

0·79 mm. broad anteriorly, 1·1 mm. in its widest portion and 0·77 posteriorly; the next, 1·65 long by 0·62 mm. anteriorly and 0·91 posteriorly; the next 1·76 mm. long by 0·81 and 0·55 mm. broad respectively; while the following segment, the final one of the strobila, measures 2·475 mm. in length with a breadth varying between 0·50 anteriorly, 0·60 at its maximum, and only 0·275 mm. at the posterior end. In that strobila the ratio of breadth to length has changed from 4 : 3 anteriorly to 1 : 5 posteriorly (based on the average width of the final segment). In another strobila the terminal segment is 1·92 mm. long by 0·66 broad; the preceding one, 1·82 by 0·80; while the earliest egg-bearing segment is quadrate, being 1·32 mm. long and broad. In another case the final segment is 2·2 mm. long by 0·77; the preceding one, 1·87 by 1 mm.; and the first egg-bearing proglottis (that in front of the latter), 1·82 by 1·1 mm. It will thus be seen that the ratio of breadth to length of terminal segments varies between 1 : 5 and 1 : 3, or even 1 : 2.

Sexual development proceeds rapidly in this species, genital anlagen of the uterine ducts and the sex pores being recognisable in about the eighth segment, 2·4 mm. behind the anterior end of the strobila. These anlagen become definitely restricted to a narrow deeply staining median zone within the succeeding two segments; and testes and vitellaria may be just recognisable in the next one (11th or 12th), becoming much more defined in the 13th. In the 14th the earliest eggs may be present in the uterus, and in the next and succeeding few segments the yolk glands reach full size and are very abundant, occupying the lateral regions of the proglottis. In one strobila the segment with the earliest anlagen of the genital ducts measures 1·32 wide by 0·33 mm. long; that with the first trace of testes, 1·54 mm. wide by 1·01; the segment immediately in front of that bearing the first eggs, 1·54 by 1·81 mm. long; the first ovigerous proglottis 1·54 by 1·87; and the last 1·21 broad by 2·7 mm. long (ratio 1 : 2). The first ripe eggs may appear in the eighth segment. The very rapid development of the ovary and vitellarium after their anlagen are first recognisable, is rather remarkable.

There are about 40 testes on each side of the segment, forming a well-defined lateral zone, leaving the median half of the proglottis free from them. The testicular field is somewhat broken at the end of each segment. Leiper and Atkinson stated that there was always, running toward the caudal end of the female organs, a definite row of three or more testes marked off by their direction from the remainder (see their fig. 41). This is incorrect, as they have mistaken the postovarian vitelline follicles for male glands. Leiper and Atkinson stated that the organs occurred just as abundantly on the outer as on the inner side of the excretory canals which lie at the junction of the middle and outer thirds of the segment. This remark is true of the yolk glands, but not of the testes. The majority of the testes lie laterally from the main longitudinal nerves, but the excretory canals were not seen, as the material was not sectioned. In our specimens each testicular field does not extend inwards beyond about one-quarter of the breadth of the segment, whereas the yolk glands occupy a much wider field. The structures marked as testes in the original figure (fig. 41) almost certainly include vitellaria. In segments which have reached the egg-bearing stage, testes are large, rounded (0·065—

0·07 mm. in diameter) and poorly staining, hence difficult to see, whereas the yolk glands are much smaller, deeply staining and very abundant. The cirrus sac is prominent, circular in outline, measuring 0·12 mm. in diameter. Just behind it is a somewhat pyriform vesicula seminalis, 0·07 mm. across and about 0·1 mm. long. The cirrus was seen extruded in several segments as a short thick smooth organ, 0·1 mm. long by 0·03 mm. wide.

The common genital aperture is situated a little in front of the mid-length of the proglottis, except in very elongate rugose segments where it is located midway, or just behind that point. The vaginal pore lies to one side of, and just behind, the male aperture. The uterine opening is placed a little further back and on one side of the median line.

The ovary is an extremely thin organ in the anterior part of the posterior third of the segment, its breadth being about 0·55 mm. and its length about 0·45 mm. Its wings extend rather more posteriorly than anteriorly and those lying behind the shell gland curve inwardly and may almost meet. The lobes are ill-defined and appear to fuse so that an ovarian reticulum is produced. The ripest eggs are found in the inner portions of the organ and in the narrow isthmus which joins the wings ventrally to the other ducts. A rather long, curved, ventrally-situated oviduct passes from the isthmus to a point behind the posterior end of the receptaculum seminis with which it communicates by means of a small canal. It then receives the yolk duct and, as a narrow curved canal surrounded by the shell glands, passes obliquely forwards to widen into the uterus. All these ducts occupy a very small compact area just behind the isthmus. The uterus is soon thrown into a series of short loops behind and above the isthmus and the vagina to terminate at the uterine pore. The uterus, just before it receives any eggs measures about 0·52 mm. in a direct line from the pore to the posterior end of the shell gland, and about 0·088 in width. In the succeeding segment, the organ contains a few eggs and measures 0·53 mm. long by 0·11 mm. wide (the egg-bearing portion being 0·365 mm. in length), whereas in a few segments later (the final proglottid of the particular strobila) it occupies a zone 0·66 mm. long and varying in width between 0·275 and 0·33 mm. The uterine pore alternates on either side of the median line.

The vagina passes inwards from the female aperture, its course being more or less sinuous along the mid-line below the vesicula seminalis and the uterus. It crosses above the ovarian bridge and becomes widened with an elliptical receptaculum seminis which is connected with the fertilising duct by a short canal.

Leiper and Atkinson state that the uterus is small and simple and contains few eggs. Such a condition is indicated in their fig. 41, which corresponds with what is seen in the first egg-bearing segments (14th or 15th), whereas in later segments the organ is much more extensive and contains numerous eggs, though restricted in size in relation to the segment. Eggs measure 0·050 to 0·055 by 0·031 to 0·04 mm.

The yolk glands are very abundant and reach maturity a little later than the testes. They occupy on each side of the segment a field rather more than one-third of the width of such proglottis. Thus the mid-region of each segment is normally free from testes and vitellaria, except for a comparatively small group of the latter, varying in number, lying behind the ovarian region. The yolk glands occur in a dorsal and a ventral layer and a few are present in the region of the lateral extensions of the ovary. The vitelline fields are continuous from one proglottis to the next one. In highly contracted, narrow segments, the lateral fields may appear to unite in the anterior region. The post-ovarian follicles are more scattered than those elsewhere. The lateral yolk ducts pass inwards and backwards below the ovarian wings and then unite, the common duct joining the oviduct just after the junction of the latter with the duct from the receptaculum. The follicles measure 0·03 to 0·04 mm. in diameter and have four or five rounded lobes.

This species resembles *D. mobile* in many of its features, but is readily distinguished by the distribution of the testes and vitellaria; the first appearance of mature segments more posteriorly in the strobila; and the marked elongation of the posterior segments.

Diphyllobothrium mobile (*Rennie and Reid*) *Meggitt.*

Synonymy:—*Dibothriocephalus mobilis* Rennie and Reid 1912, 446–7, pl. 2, figs. 7–10; nec Leiper and Atkinson 1914, 222; 1915, 39.

Diphyllobothrium wilsoni Railliet and Henry 1912, 484–8, nec Shipley, 1907.

Dibothriocephalus coatsi Leiper and Atkinson 1914, 222; 1915, 40–41, pl. 5, figs. 37, 38; nec Rennie and Reid 1912.

Dibothriocephalus mobilis Fuhrmann 1921, 484–8, figs. 46–55.

Dibothriocephulus mobilis Fuhrmann 1921, 484.

Diphyllobothrium mobilis Meggitt 1924, 114; Fuhrmann 1931, fig. 354.

This species was originally described from the Weddell seal (Rennie and Reid 1912). Fuhrmann (1921) restudied the type material as well as additional specimens collected by the "Gauss" from that host and from the Ross seal. He also studied the "Pourquoi-pas" specimens taken from the Weddell seal and regarded by Railliet and Henry (1912) as *D. wilsoni*, but he reported them as belonging to *D. mobile*. Fuhrmann (1921) has given a good account of the species and has figured the early stages in the development from the plerocercoid (1921; 1931).

Leiper and Atkinson (1914; 1915) identified as *D. coatsi* Rennie and Reid, a small species of cestode occurring abundantly in the upper part of the small intestine of the Weddell seal, and collected by the "Terra Nova." It is quite distinct from the species

described under that name by Rennie and Reid, whose material was obtained by the "Scotia" from the sea-leopard and was subsequently determined by Fuhrmann (1921) as a synonym of *D. quadratum* Linstow. Leiper and Atkinson's account and figures (1915) of the parasite, identified as *D. coatsi*, indicate that their species was *D. mobile* as described and figured by Fuhrmann (1921). The species identified as *D. mobile* by Leiper and Atkinson (1914; 1915) is not that described by Rennie and Reid (1912), but is the same as that described by Shipley as *D. wilsoni*.

A few examples of *D. mobile* were found amongst the material obtained by Dr. Hunter from the Ross seal near Drygalski Island off Queen Mary Land (January, 1914) and the species was abundantly represented amongst specimens of *D. perfoliatum* from Weddell seals, collected by Dr. Hunter and by Dr. McLean in Adelie Land during 1912. Some of the specimens were plerocercoids resembling those figured by Fuhrmann (1921, figs. 48–50; 1931, fig. 354).

DIPHYLLOBOTHRIUM PERFOLIATUM *Railliet and Henry.*

Synonymy—Diphyllobothrium perfoliatum Railliet and Henry 1912, 155–6.

Diphyllobothrium perfoliatum Leiper and Atkinson 1914, 222; 1915, 43–4, fig. 8.

Diphyllobothrium clavatum Railliet and Henry 1912, 156–7.

Dibothriocephalus perfoliatus Fuhrmann 1921, 470–6, figs. 1–19, pl. 56, fig. 1.

In another part of this report it is suggested that *D. rufum* Leiper and Atkinson 1914, may be a synonym.

This parasite has been collected by the "Pourquoi-pas," "Terra Nova" and "Gauss" expeditions from the Weddell seal. It is abundantly represented amongst the "Aurora" collection, having been taken from this seal on several occasions by Dr. Hunter at Commonwealth Bay during 1912, and in the same region by the late Dr. McLean in 1913. The notes show that on one occasion it occurred in such numbers as to fill the duodenum.

The longest specimens are 250 mm. but most of them are between 100 and 180 mm., while others are about 40 to 50 mm. The characters of the species are well described in Fuhrmann's account (1921). This author re-examined Railliet and Henry's type material of *D. perfoliatum* and *D. clavatum* and pronounced them to belong to the same species, the former having priority. Railliet and Henry (1912, 157) mentioned that some poorly preserved, considerable attenuated, cestodes with segments in the form of a circumflex, which were taken from the intestine of a crabeater seal, *Lobodon carcinophagus*, probably belonged to *D. clavatum*, i.e., to *D. perfoliatum*.

Diphyllobothrium quadratum (*Linstow*) *Railliet and Henry.*

Synonymy—Bothriocephalus quadratus Linstow 1892, 12–15, pl. 3, figs. 28–32.

Bothriocephalus quadratus Ariola 1900, 411, pl. 9, fig. 56.

Dibothriocephalus quadratus Zschokke 1903, 4; Rennie and Reid 1912, 443–4.

Dibothriocephalus coatsi Rennie and Reid 1912, 443–4, pl. 1, figs. 5, 6; nec Leiper and Atkinson 1914, 222; 1915, 40–41.

Diphyllobothrium quadratum Railliet and Henry 1912, 154.

Diphyllobothrium resimum Railliet and Henry 1912, 153–4.

Diphyllobothrium resimum Fuhrmann 1921, 476.

Dibothriocephalus quadratus Fuhrmann 1921, 476–481, figs. 20–35, pl. 56, fig. 2.

Bothriocephalus coatsi Fuhrmann 1921, 476.

Diphyllobothrium coatsi Meggitt 1924, 110.

This species was first described by Linstow (1892) from material taken from a sea leopard, in South Georgia. The account given did not allow satisfactory comparisons to be made, so the same species came to be described by Rennie and Reid (1912) as *Dibothriocephalus coatsi* (based on "Scotia" material, presumably from the South Orkneys) and by Railliet and Henry (1912) as *Diphyllobothrium resimum*, the species having been collected by the "Pourquoi-pas" at Petermann Island (off Graham Land). Fuhrmann (1921) studied specimens, also from the sea leopard, collected by the "Gauss" in 1902, while in the pack ice off Kaiser Wilhelm Land. He also re-examined the type material of Rennie and Reid's, as well as of Railliet and Henry's species, and announced their synonymy with Linstow's *D. quadratum*.

The "Aurora" material contains several collections by Mr. H. Hamilton from sea leopards at Macquarie Island and one by Dr. McLean from the same host species in Adelie Land in 1913. The worms possess typical anatomy. The variability of the form of the scolex is indicated by Fuhrmann (1921).

Diphyllobothrium scoticum (*Rennie and Reid*) *Meggitt.*

Synonymy—Dibothriocephalus scoticus Rennie and Reid 1912, 442–3, pl. 1, figs. 1, 2; Fuhrmann 1921, 492–3, figs. 63*a–b*.

Dibothriocephalus pygoscelis Rennie and Reid 1912, 447–8, pl. 1, figs. 11–12; Fuhrmann 1921, 493–4.

Diphyllobothrium scoticum Meggitt 1924, 115.

This species is represented in two collections from sea leopards from Macquarie Island, in one of them *D. quadratum* being also present. One collection contains a single parasite which is in fragments that total over 200 mm. In the other is a specimen

250 mm. long but with the scolex missing, and there is a worm with the scolex present, this cestode measuring 85 mm. The maximum breadth of the broad flat segments is 9 mm. Fuhrmann (1921) re-examined Rennie and Reid's type of *D. scoticum* and gave a more satisfactory description of it.

Rennie and Reid (1912) gave an account of some specimens, described as *Dibothriocephalus pygoscelis* from a penguin, either *Pygoscelis antarctica* or *P. adeliae*, remarking that the scolex resembled that of *D. quadratum* in form and size, but that the dimensions of the segments and eggs were quite different in the two species. The large size of the eggs was specially referred to. The largest worm measured 290 mm. with a maximum breadth of 9 mm. Fuhrmann (1921) re-examined the type material and gave a more detailed account of it, accepting Rennie and Reid's statement as to the host.

In a footnote to the original description (p. 447) and in the Zoological Log of the "Scotia" Expedition (p. 95 and footnote) it is stated that the worms were found by Dr. Pirie lying in the snow near the beach at Scotia Bay, South Orkneys, where a number of penguins had been congregating—chiefly *Pygoscelis antarctica* and *P. adeliae*, January 11, 1904. In the subantarctic islands I have seen sea elephants commonly, and sea leopards occasionally, in the vicinity of various species of penguins, and, in the case of the former seal, lying in penguin rookeries. In the Antarctic I have observed Weddell seals on beaches adjacent to Adelie penguin rookeries and sea leopards may be similarly found there, though much more common in the pack ice, In one collection of cestodes from Adelie Land, a note is included "ejected from the anus of a sea leopard."

A comparison of the accounts given by Rennie and Reid, and especially by Fuhrmann, for *D. pygoscelis*, with the broad tapeworm, *D. scoticum* from the sea leopard convinces me that the two are synonymous and that the true host of the former was not a penguin but *Hydrurga leptonyx*. *D. scoticum* has page priority over *D. pygoscelis*, hence the latter name should be suppressed.

Diphyllobothrium rufum *Leiper and Atkinson.*

(Figs. 9–11.)

This small species was described rather inadequately and without figures (1914, 224; 1915, 44–5). It was stated to occur along with *D. perfoliatum* in the first few valvulae conniventes of the Weddell seal in the Ross Sea region.

Two specimens were found amongst a number of *D. perfoliatum* taken from the same host species at Commonwealth Bay. Both possessed the typical Indian-club form. One measured 15 mm. in length and 2·5 mm. in maximum breadth, the latter being maintained for about one-third of the length of the strobila. These segments were markedly imbricate as in *D. perfoliatum*. The terminal proglottids were considerably narrower and rather longer than the rest. A distinct notch was usually present in the mid-ventral edge of the overlapping region. The scolex was about 0·75 mm. across

and this breadth was maintained till it met the first segment. There was practically no neck region, segmentation occurring close to the posterior end of the narrow suckers. The latter overlap and measure about 1·1 mm. in length. There was a gradual increase in breadth until the maximum was reached at about 8 mm. from the anterior end. The increase in the length of segments was gradual.

The other specimen was 20 mm. long by 2·8 mm. in maximum width and possessed a similar form except that the scolex was much more elongate and club-shaped. The latter measured 0·7 mm. across, narrowing to 0·4 and then widening to 0·7 mm. where the segmentation began. The long narrow bothridia were 1·8 mm. long. There was practically no neck, as segments appeared 0·2 mm. behind the end of the bothrium. The final segment was 1·26 mm. wide. Calcareous corpuscles were abundant in the larger proglottids. Genital anlagen appeared at about 12 mm. from the anterior end in both strobilae, but the actual sex glands were not yet developed, though the sex ducts were being differentiated; hence a comparison of the anatomy of these specimens with the account of the " Terra Nova " material cannot be made.

The two specimens are assigned to *D. rufum* mainly because of the general shape of the strobila, the absence of an unsegmented neck, and the early appearance of the genital anlagen. These immature worms are much smaller than those measured by Leiper and Atkinson, and the bright scarlet pigment band mentioned by them as occurring on the scolex was not observed, the method of fixation probably being responsible for its absence.

Except for the features mentioned, the parasites would have been assigned to *D. perfoliatum*. It is probable that *D. rufum* may be merely a short-necked, precocious form of *D. perfoliatum*. Leiper and Atkinson in their accounts of these two species stated that the testes extended into the lateral portions of the segments. Fuhrmann's figures (1921) show that it is the vitelline organs which lie in that situation in *D. perfoliatum* and no doubt the two former authors have confused testes and vitellaria in the two species.

Diphyllobothrium scotti (*Shipley*) *Meggitt*.

Synonyms :—*Dibothriocephalus scotti* Shipley 1907, 3–4, figs. 3–7.

Dibothriocephalus scotti Fuhrmann 1921, 490–92, figs. 60–62.

Diphyllobothrium scotti Meggitt 1924, 115.

Diphyllobothrium sp. Railliet and Henry 1912, 160.

? *Bothriocephalus tectus* Linstow 1902, 285; nec. 1891, 15.

A few examples of this slender parasite were taken along with *Glandicephalus antarcticus* from a Ross seal, *Ommatophoca rossi*, by Dr. Hunter, off Queen Mary Land, in January, 1914. It had been collected only once previously, viz.. by the " Discovery "

in the Ross Sea (Shipley 1907). Fuhrmann (1921) re-examined Shipley's material and gave a more detailed account of the species. The "Aurora" specimens are immature and fragmentary. The largest of Shipley's parasites reached 9 cms. by 2 mm. and possessed about 140 segments.

Railliet and Henry referred briefly to the presence amongst the French Antarctic Expedition's material from the Ross seal of some juvenile indeterminable specimens (*Diphyllobothrium* sp.) in the form of fragments 10–20 mm. long by about 1 mm. broad. There is little doubt from their dimensions that these belonged to *D. scotti*. Linstow's record (1902) of *Bothriocephalus tectus* from the Ross seal ("Southern Cross") probably relates to *D. scotti*, but may possibly be to *Glandicephalus antarcticus*.

Diphyllobothrium tectum (*Linstow*) *Meggitt*.

Synonymy—Bothriocephalus tectus Linstow 1892, 15–17, figs. 25–27; Ariola 1900, 453.

Dibothriocephalus tectus Zschokke 1903, 4.

Dibothriocephalus tectus Fuhrmann 1921, 488–90, figs. 56–59.

Diphyllobothrium tectum Meggitt 1924, 115.

Three small macerated specimens, one of them lacking a scolex, taken by H. Hamilton from the lower intestine of a young sea elephant on Macquarie Island, are referred to Linstow's species. They are about 10 mm. long with a maximum breadth of about 1·5 mm. The terminal segments are rectangular and about three times as broad as long. They are thick and overlap very little. The genital pore lies in the mid-line of the anterior third of the proglottis.

The condition of the specimens is unsatisfactory, some of the segments being considerably distorted. Fuhrmann (1921) who re-examined Linstow's type material, quoted the host as *Cystophora tectus* (p. 488), and as *Cystophora proboscidea* (p. 522), the latter being the name used by Linstow whose material came from South Georgia.

The reference to *Bothricephalus tectus* by Linstow (1902, 285) as having been identified from a Ross seal taken by the "Southern Cross," is probably to *Diphyllobothrium scotti*, or possibly *Glandicephalus antarcticus*. Though the sea elephant and Ross seal both feed very largely on cephalopods, the normal ranges of the two pinnipeds do not overlap.

Diphyllobothrium wilsoni (*Shipley*) *Meggitt*.

Synonymy—Dibothriocephalus wilsoni Shipley 1907, 4–5, fig. 8.

Dibothriocephalus wilsoni Rennie and Reid 1912, 446, pl. 1, fig. 4, nec Railliet and Henry 1912, 154.

Dibothriocephalus mobilis Leiper and Atkinson 1915, 39–40, nec Rennie and Reid.

Dibothriocephalus wilsoni Fuhrmann 1921, 481–484, figs. 36–45.

Diphyllobothrium wilsoni Meggitt 1924, 115.

Diphyllobothrium wilsoni Fuhrmann 1931, fig. 335.

Two specimens of this very minute cestode were found amongst the material taken from the duodenum of a Ross seal off Queen Mary Land in January, 1914, by Dr. Hunter. A few more were discovered in a bottle containing numerous specimens of *D. perfoliatum* from the duodenum of the Weddell seal, collected by Dr. Hunter in February, 1912, in Commonwealth Bay. The species was first described from material from the Ross seal brought back by the "Discovery." Rennie and Reid recognised it amongst cestodes taken by the "Scotia" from the Weddell seal, *Leptonychotes weddelli*. Railliet and Henry reported the species as having been taken by the "Pourquoi-Pas" from the Weddell seal in Graham's Land, but Fuhrmann (1921, 481) has pointed out that these investigators were in error and that the species described by them was the related *D. mobile*. Fuhrmann (1921) re-examined the "Discovery" and "Scotia" material, as well as numerous specimens collected by the "Gauss" in February, 1902, whilst the ship was drifting in the pack ice, these having been taken from the Ross seal and from the leopard seal, *Hydrurga leptonyx*.

Shipley's specimens reached a maximum length of 4 to 5·5 mm. by a maximum of 1 mm. in breadth; Rennie and Reid's from under 4 to 10 mm.; while Fuhrmann (1921) stated that the parasites often reached only 2 to 3 mm. when sexually mature, though generally 6 to 7 mm., and exceptionally 10 mm., was the length, the maximum breadth being 1 to 1·7 mm. Baer (1925, 16) has erroneously quoted one host as *Ommatophoca wilsoni* (for *O. rossi*).

The minute parasite from the stomach and upper intestine of Weddell seal described briefly by Leiper and Atkinson (1915) as *Dibothriocephalus mobilis* appears to be *D. wilsoni*.

Diphyllobothrium *sp.* (*plerocercoid*).

A single specimen was obtained from a fish, *Notothenia coriiceps*, taken in Commonwealth Bay. The location in the host is not mentioned. The dimensions are—length 7 mm., breadth 1·6 mm., and practically uniform behind the scolex. The latter is narrower, its maximum width being 1·2 mm. The suckers are 1·2 mm. long and overlap only slightly when approximated. The form of this larva suggests that it may belong to *D. quadratum*, or perhaps to *D. perfoliatum*.

A very small plerocercoid was obtained from a cyst on the liver of *Trematomus hansoni* from 250 fathoms off Queen Mary Land.

Plerocercoids of *D. mobile*, as figured by Fuhrmann (1921, figs. 48–50) were found in collections from the intestine of Weddell seals in Commonwealth Bay.

Leiper and Atkinson referred to the presence of plerocercoids under the mucosa of pyloric processes of the fish *Trematomus bernacchii*, but no dimensions were mentioned (1915, 45, pl. 5, figs. 39, 42).

GLANDICEPHALUS ANTARCTICUS (*Baird*) *Fuhrmann*.

Synonymy—Bothriocephalus antarcticus Baird 1853 *a*, 90; 1853 *b*, 25, pl. 31, fig. 4; 1855, 76.

Dibothrium antarcticum Dies. 1863, 241–2.

Bothriocephalus antarcticus Ariola 1900, 448, pl. 10, figs. 116–117.

Diplogonoporus antarcticus Luehe 1899, 50; Zschokke 1903, 19, 28; Leon 1910, 26.

Dibothriocephalus antarcticus Shipley 1907, 1–3, figs. 1, 2; Rennie and Reid 1912, 445.

Diphyllobothrium antarcticum Railliett and Henry 1912, 158–160.

Glandicephalus antarcticus Fuhrmann 1921, 494–9, figs. 64–70; 1931, figs. 292, 330, 339, 324.

(?) *Krabbea antarctica* Blanchard 1894, 702.

(?) *Bothriocephalus tectus* Linstow 1902, 285; nec 1892.

This species was taken from the duodenum of a Ross seal, off Queen Mary Land on 22 January, 1914, by Dr. J. Hunter, and is represented in the Australian Antarctic Expedition's material by a few specimens. The "Aurora" on that particular date was just off Drygalski Island, so the host animal must have been taken in the pack ice in the vicinity of Station 7.

Baird's accounts are short but his figure closely resembles the parasite. The host was stated to be a seal collected by the "late Antarctic expedition" referring, no doubt, to that led by Sir James Clark Ross in the "Erebus" and "Terror" (1841–3). Ariola (1900) gave two figures of the scolex showing the characteristic process near the posterior end of each bothrium, his figures being based on notes made by Monticelli when he re-examined various entozoa in the British Museum collection. Diesing (1863), Linstow (1878), Blanchard (1894), Matz (1891), Germanos (1895) and Ariola (1900) quoted the host as *Phoca* sp. Shipley's material, taken by the "Discovery" in the Ross Sea, came from the Ross seal, as Baird's must have done since the Ross Expedition brought back that rare seal and the name of the leader of that expedition was associated with it (*Ommatophoca rossi*) by its describer, Gray (Zool. Erebus and Terror, Mammals, 1884). pt was collected again by the "Scotia" (Rennie and Reid 1912) and by the "Pourquoi-Ias" (Railliet and Henry 1912). Though the "Gauss" did not obtain it, Fuhrmann

included an excellent account of it in his report (1921) after having restudied Shipley's specimens; and he erected a new genus, *Glandicephalus*, to receive it on account of certain characters possessed by the sucking grooves and because of the relation of the ovary and testes to the longitudinal muscle bundles.

Baird's specimens were about 23 cm. long, and Shipley's ranged from 3 cm. to nearly 10 cm. in length, with a maximum breadth of 7 mm. Rennie and Reid gave as dimensions 132 mm. by 4·5 mm., and Railliet and Henry 40–45 mm. by 4·5–5 mm. The "Aurora" specimens are generally between 80 and 90 mm., but one was only 27 mm., while the largest measured were 140 and 120 mm. respectively.

Fuhrmann (1931, fig. 339) referred erroneously to the host animal, *Ommatophoca rossi*, as the sea leopard.

PHYLLOBOTHRIIDAE.

PHYLLOBOTHRIUM *sp.* (*larva*), near *P. unilaterale* (Southwell).

Synonyms—Phyllobothrium sp. Rennie and Reid 1912, 450–1, pl. 2, figs. 13, 14; Fuhrmann 1931, 184, fig. 216.

Three specimens were taken by Mr. H. Hamilton from the blubber of a sea elephant on Macquarie Island. All of them have the scolex fully everted. These cysticerci measure from 58 to 68 mm. in length. The neck is much narrower than the bladder and has an even diameter of 2·5 to 3 mm., but at its distal end the bladder is sharply marked off from it and extends for 34 to 42 mm. as a cylinder with a fairly uniform diameter of 9 to 11 mm. The posterior end of each cyst is bluntly rounded. The scolex is not marked off from the neck by any difference in diameter, apart from the slightly projecting bothridia. The latter are considerably folded in their marginal regions and closely resemble those figured by Fuhrmann (1931, fig. 216). The accessory suckers are very small and not readily seen, being more or less buried in the tissues of the scolex. In one specimen the apex of the latter projects prominently.

Rennie and Reid (1912) gave a brief description of two similar larvae taken by the "Scotia" from the blubber of the Weddell seal. The complete specimen was about 50 mm. long, with a maximum width of 10 mm. along the bladder. The four bothridia were much folded and accessory suckers were stated to be absent. The figure of the scolex is rather diagrammatic.

Fuhrmann (1931) published a figure of the scolex of *Phyllobothrium* sp. from the blubber of the Weddell seal, showing rounded bothridia each with a considerably folded margin and with a small rounded accessory sucker in front. In his report on the "Gauss" cestodes no reference is made to the occurrence, but since he re-examined Rennie and Reid's "Scotia" material, it is reasonable to assume that this figure belongs to a "Scotia" specimen, in spite of the presence of definite accessory suckers.

Leiper and Atkinson (1915, 22) mentioned that cestode cysts were found by the "Terra Nova" Expedition in the blubber of seals (presumably Weddell seals from the Ross Sea) but were not brought back, and that their presence had been noted by Dr. Bruce of the "Scotia" Expedition.

Fuhrmann's figure of the scolex of the bladder worm from the Weddell seal closely resembles Zschokke's (1888) figure of that of *Phyllobothrium thridax*, but Southwell (1925, 155, fig. 89) regarded the latter as distinct from Beneden's *thridax* and renamed it *P. unilaterale*. Woodland (1927, 528–9, pl. 4, figs. 47–49) gave a short account of a cestode which he believed to be *P. unilaterale* Southwell, but accessory suckers were not found and the figure of the scolex shows a simple margin, as in *Anthobothrium*, so that it is possible that he did not examine the same species as that described by Zschokke. Zschokke's and Beneden's specimens came from *Raja* spp. and *Squatina* from Naples and Belgium. Beneden (1858) also described a species, *P. auricula*, closely related to *P. thridax*, taken from a ray, *Trygon*, while Linstow (1878) recorded it from *Scymnus glacialis*, i.e., the Greenland shark. Southwell (1925) considered these two species, *P. thridax* and *P. auricula*, as synonymous.

The sea elephant is a new host for the parasite and the range is now extended from the Ross Sea and the Graham Land—South Orkneys region to Macquarie Island.

It is a matter for speculation as to what animal is likely to be the host for the adult stage. Dr. Bruce (Rennie and Reid 1912, 451) suggested that it might occur in a grampus, as he had found the sea leopard and crab-eater frequently with large gashes on their sides due, he believed, to attacks by *Orca* sp., the Weddell seal probably being liable to attack also. He mentioned that certain southern birds were fond of blubber, viz., the giant petrel, *Ossifraga* (= *Macronectes*) *gigantea*, skuas (*Megalestris*, i.e., *Catharacta antarctica* and *M. maccormicki*), and sheath-bills (*Chionis—Chinois* in error), and that the normal host might possibly be one of these.

We have seen crab-eater and Weddell seals marked as mentioned by Bruce and have seen one of the former hunted and caught by a pack of killers, *Orca gladiator*, two of the latter dividing the seal between them. Entozoa have not yet been recorded from this ferocious cetacean, while from the related *Pseudorca crassidens* only an acanthocephalan has been reported, and from *Grampus griseus* (Risso's dolphin) only larval stages of a Phyllobothriid. No adult Phyllobothriid cestode is known from any cetacean, though larval stages have been recorded.

A larval form, *Phyllobothrium* (*Pollybothhrum* in Southwell 1925, 182) *loliginis* (Leidy) from North American species of squids belonging to *Ommastrephes* and *Loligo*, was described as having four variable bothridia each with a crumpled folded border and an accessory sucker. A terminal papillary eminence (myzorhynchus) was present. The parasite was described originally as *Taenia loliginis* by Leidy in 1887 and transferred by him in 1890 to *Tetrabothrium*. Linton (1897) later placed it under *Phyllobothrium* and reported a number of hosts, the list being augmented still later (Linton, 1922) in a daper in which he brought forward evidence suggesting that this larva which occurs in

cephalopods, bony fish and elasmobranchs, was the young stage of a cestode, *Phyllobothrium tumidum* Linton 1922, found in the sharks *Carcharodon* and *Isurus*, which feed on fish and cephalopods. His figures, especially figs. 1 and 2, are very suggestive of the parasite from southern seals. He pointed out that Beneden's figure of *Phyllobothrium delphini* Ben. closely resembled the parasites from North American squids.

Since some cetaceans feed mainly on cephalopods, as also do the sea elephant and Ross seal, and at times the Weddell seal, as personal observations in the Antarctic have indicated, it may be that these mammals serve as a second intermediate host. Linton (1922) recorded many species of teleost fish which harbour the larval form in the digestive tract, and mentioned several species of elasmobranchs (*Raja*, *Mustelus*, *Squalus*) in which the larval stage had been found but in which the adult form had not been taken. Cetaceans and seals feed largely on fish and, in the case of the former, especially amongst the Odontocetes, similar larvae have been recorded occupying situations in the blubber just as occurs in the antarctic Weddell seal and the subantarctic sea elephant. The earlier records of such parasites from cetaceans were collected by Cobbold (1879, 421–2), while Baylis assembled recently a list of all recorded helminths from this group of mammals, and mentioned a number of forms attributed to *Phyllobothrium* and *Monorygma* which he regarded apparently as distinct genera (1932, 399, 400). Southwell (1925) and Fuhrmann (1931) listed the two as synonymous, while Meggitt (1924) considered them distinct and his generic assignment of the larval stages from cetaceans is the same as that given later by Baylis. Many seals and cetaceans utilise fish as a part of their diet and it is possible that the Phyllobothriid cysticerci found in these mammals may have been derived from larvae such as Linton recorded as occurring in fish. The mammals would then constitute a second intermediate host, whereas if such fish were eaten by a suitable elasmobranch, then the adult stage would develop.

The only known hosts for adult *Phyllobothrium* and *Monorygma* are, apart from a sea-snake, elasmobranchs, but an infection of those seals which are restricted to the Antarctic and Subantarctic, e.g., *Leptonychotes weddelli* and *Mirounga proboscidea*, presupposes the presence of some elasmobranch in those waters. If these seals are not necessary intermediate hosts, then there is no need to postulate the presence of huge sharks in those regions. There are no records known to me of elasmobranchs from the region of the Antarctic continental shelf and the pack ice, but some species of rays occur at Kerguelen, and a large shark, ? *Somniosus* sp.*, allied to the Greenland shark, was found in 1912 by the Australian Antarctic Expedition washed ashore on Macquarie Island, where the infected sea elephant was examined. The Greenland shark, *Laemargus glacialis* (*borealis*), is an inhabitant of Arctic waters and attacks whales and presumably smaller aquatic mammals.

Baylis (1919, 417–24) gave an account of some cysts of *Cysticercus Taeniae-grimaldii* Moniez, found in the subperitoneal tissues of a dolphin, *Lagenorhynchus acutus*, on the English coast. These are much smaller and the scolex is shown as possessing a larg-

* Waite, E. R. Fishes. Austr. Antarct. Exp. Sci. Rep.. C. 3 (1), 1916, 51–2.

terminal papilla and rather thick bothridia, each with a plain border and with an anterior sucker. The larva was assigned to *Monorygma*, near *M. elegans* Monticelli (as described by Zschokke 1889 under the name of *M. perfectum* Dies.). *M. perfectum* is a parasite of the Greenland shark, *Laemargus borealis*, which has the habit of biting out pieces of the flesh of living cetaceans (p. 423). In his list of the known species of *Monorygma*, *M. dentatum* Linstow is stated in error to have come from an unknown Antarctic shark, whereas it was taken in the Atlantic in the vicinity of the equator. A species of *Monorygma* is described in the present paper as occurring in *Somniosus* from Macquarie Island, but its scolex is quite different from that of the *cysticerci* from southern seals.

Leiper and Atkinson (1914, 225; 1915, 46) reported the occurrence of a small larval stage, *Anthobothrium wyatti* L. & Atk., in the tissues of the rectum of an antarctic fish, *Trematomus bernacchii*. In their brief unfigured account they stated that there were four auricular discs, each carrying a pair of round suckers, and that the rostellum also was occupied by a muscular sucker. The suckers on each "auricular disc" were stated to lie one in front of the other. The forms are obviously not members of the genus *Anthobothrium*. Southwell (1925, 202, 203, 204–5) placed them amongst the doubtful species and assigned them to *Orygmatobothrium*, apparently identical with *O. versatile* Dies. The most that one can say is that the parasite is a larval form, *Orygmatobothrium wyatti* (L. & Atk.), but the occurrence is evidence of the presence in antarctic waters of some, as yet unknown, elasmobranch.

If we sum up the evidence, then it seems likely that the parasite of southern seals belongs to *Phyllobothrium unilaterale* Southwell, or to a closely related species such as *P. tumidum* Linton, or perhaps *P. thridax* Ben.

Monorygma macquariae *n. sp.**

(Figs. 12–67.)

From a large shark cast up on the beach at Macquarie Island and determined by Waite† as *? Somniosus* sp.; one of the Scymnorhinidae, Mr. H. Hamilton collected a few large Phyllobothriid cestodes. The longest piece, devoid of a scolex, measures over 50 cm. and its widest proglottids attain a breadth of 7 mm. and a length of 3 mm. The segments do not overlap and are rather flat except at maturity, when they are somewhat thicker, possessing an elongate elliptical cross section, this being due chiefly to the great development of the secondary uterus. Those segments in which the latter organ is more or less emptied of eggs are much shorter and more flattened, even though interpolated between thicker, egg-laden, proglottids, the diminished size being due in part to muscular contraction. Posteriorly to this region the strobila becomes narrowed and the individual segments are nearly square (about 3·5 mm. in length and breadth, but occasionally longer than broad, some final proglottids being 3·5–4 mm. long by

* See also additional note on this species on page 59 of this Report.

† E. R. Waite. Report on the Fishes. Scientific Report Aust. Antarctic Exp., C. 3, (1), p. 51, fig. 10.

2·5 mm. broad). Each mature segment has a prominent rounded elevation on the ventral surface marking the position of the secondary uterus, a circular uterine pore being located more or less centrally in the area. The absence of obvious constrictions between egg-bearing segments suggests that the latter do not become detached to undergo further considerable development in the intestine of the host, such as is known to take place in several species of Tetrabothridiate cestodes, but that, on detachment, they make their way to the exterior. It should be mentioned, however, that eggs in final segments of the strobilae examined are only in an early stage of segmentation, though uterine pores are present.

The scolex is relatively very large and especially broad. Its widest region is in the posterior portion and measures about 4·5 mm., the total length being about 3·1 mm. On each surface are two prominent bothridia, each provided anteriorly with a rather large accessory sucker, the breadth of the scolex at the level of the posterior region of these acetabula being about 2 mm. The two bothridia and suckers of each surface are in close contact along most of the length of their inner edges, but there is an interval between the acetabula of opposite surfaces, while the dorsal and ventral bothridia are close to each other basally.

When viewed from the front, the scolex is seen to have a thickness of 2·4 to 2·5 mm. Between the adhesive apparatus of opposite sides there is a wide groove formed by the bases of the bothridia, the depression being shallow anteriorly between the dorsal and ventral acetabula. At each end of the groove are two projections marking the anterior and outer edge of the bothridia. Each accessory sucker projects prominently beyond the anterior portion of the bothridium and is separated from its fellow of the same surface by a narrow groove at right angles to the main transverse groove but not crossing it. The suckers face mainly dorsally or ventrally, there being only a slight turning outwardly.

When viewed from the dorsal or ventral aspect the accessory suckers are seen to project very prominently and to be separated from each other by a deeper slit-like groove. The posterior edge of these organs is nearly straight, there being a slight backwardly-directed concavity, so that the posterior corners appear as bluntly rounded processes. The anterior portion is rounded while the whole organ is strongly muscular, with a rather deep cavity. Each sucker measures about 0·9 mm. in width and length. The bothridia have an entire margin and are very wide, somewhat ear-like and rather flat, with the deepest part anteriorly and lying towards the median line of the scolex. The inner edges of the bothridia are narrow and project more prominently than the outer and posterior, so that the cavity is more pronounced in this region, but it gradually becomes shallower, the posterior half of each bothridium being almost flat. The cavities are directed upwards and slightly outwards. The greatest width of the bothridium is in its posterior half or third, and reaches 2·3 to 2·5 mm., while the length from the hind border of the acetabulum to the posterior border of the bothridium measures from 1·9 to 2·3 mm.

When the scolex is viewed laterally the bothridia of opposite surfaces are seen to be separated anteriorly by a wide, shallow depression, but posteriorly by a deep groove, since each has a very thick basal portion, the scolex in its posterior region measuring 2·4 mm., while at the level of the acetabula its thickness is 2 mm. In lateral view the accessory suckers project considerably beyond and above the anterior part of the corresponding bothridium.

There is a very short neck, about 2 mm. wide, segmentation being recognisable at from 2 to 3·5 mm. behind the end of the scolex, where the bases of the four bothridia closely invest the anterior portion of the neck region (fig. 22).

The cuticle is very thin. Below it are longitudinal and circular muscle fibres, the latter being well developed and very numerous and seen well in longitudinal section of segments. The subcuticula occupies a rather wide zone and is much invaded by strong longitudinal muscle fibres, some of which may lie quite close to the outer circular fibres. This longitudinal musculature is very well developed, the individual fibres being large and sometimes aggregated to form small bundles. These fibres are not regularly distributed but occupy a wide region in the cortex about midway between the cuticle and the vitelline zone, while there are, in addition, numerous strands in the outer part of the cortex and amongst the subcuticular cells, as well as in the vicinity of the vitellaria. Just laterally from each main lateral nerve there is a compact mass of marginal longitudinal muscle fibres lying between the outer limits of the vitelline fields. Beyond them are the ordinary longitudinal fibres which are neither so closely arranged nor so powerful. In the vicinity of the genital apertures this marginal musculature is penetrated by the sex ducts. In segments with a well-developed uterus, the longitudinal fibres of the midventral portion of the cortex, together with the cortex itself, become displaced towards either side by the growth of that organ, so that the region in the vicinity of the uterine pore is more or less free from such fibres (figs. 38, 49). Transverse fibres are present near the vitellaria and weak dorsoventral strands cross the medulla. Calcareous corpuscles are abundant, have a well-marked concentric structure and measure about ·025 by ·017 mm.

Each main nerve is comparatively large, well-defined, circular in section, and lies just inwardly from the mass of marginal muscle fibres. In the region of the genital pore, it becomes compressed and also displaced dorsally, so as to lie immediately above the male duct.

The excretory canals have a sinuous course, the ventral being a large tube lying directly below the narrow dorsal. The sex ducts pass between them.

The testes average about 0·1 mm. in diameter and are very abundant, occupying a considerable portion of the medulla where they are arranged in two irregular layers, a dorsal and a ventral. They extend laterally to the excretory canals, but are absent from the entire middle region of the segment except in its anterior quarter, so that none

is present in the vicinity of the female genital system (excepting the vagina). The posterior limit of the testicular field is at about the level of the anterior border of the ovary. They may also overlap the margins of the cirrus sac and vagina. These glands are still abundant in proglottids with a mature uterus and they probably continue to function since, in egg-bearing segments, copulation was commonly seen.

Situated directly inwards from the end of the cirrus sac and between it and the anterior end of the uterus, is a large, rather closely coiled, thin-walled vas deferens or vesicula which may occupy almost the whole of the medulla in this region, the vagina passing between or below the coils. Some of the latter may overlie the pointed tip of the developing uterus.

The cirrus sac varies in shape and size according to the position of the cirrus, but when in a resting condition it is usually somewhat pyriform, the inner end being rounded and the outer portion cylindrical. The length, at rest, is from 1·8 to 2·0 mm. and the maximum diameter 0·4 to 0·5 mm. It is just in front of the mid-length of the segment and lies directly behind, parallel with, and on a more dorsal level than, the vagina, which its posterior, more swollen, portion may partly overlap. The wall of the sac consists chiefly of strongly developed circular muscle fibres, within which are longitudinal fibres. Crossing its cavity are abundant oblique fibres, and associated with them as well as with the musculature of the wall, are numerous myoblasts. Within the sac the male duct, when at rest, lies coiled loosely in the swollen portion. The succeeding part of the duct, situated in the cylindrical region of the sac, is not coiled and has thicker walls. The inner portion is lined by a narrow cuticle very closely beset with abundant cilia-like hairs projecting nearly 0·01 mm. into the lumen. Lying next to this is a well-defined layer of circular muscle fibres, beyond which is a series of very thick longitudinal fibres forming a definite zone whose thickness (as well as the closeness of the fibres) depends on the state of contraction of the tube, so that these fibres may form either a single or a double layer. Outside it are numerous myoblasts. When the cirrus is fully extended, all the coils of this ejaculatory duct become straightened out, so that the tube lies centrally in the long cylindrical sac. The outer part of the duct, i.e., the introverted cirrus, is wider and its strong musculature, especially the circular fibres, may be very obvious in whole preparations, whether stained or unstained. The everted cirrus (T.S. figs. 25, 26) is covered by a thin cuticle provided with abundant minute stiff hairs, quite different in size and appearance from the long cilia-like hairs lining the inside of the ejaculatory duct. The muscular layers are similar to those of the latter duct and of the wall of the sac. Oblique fibres are also present.

When the cirrus is at rest the outer part of the sac is seen to be somewhat different from the remainder. This portion, which is the first to be extruded, then assumes a bulbous form and is considerably wider than the rest of the partially or fully extended cirrus of which it forms a swollen rounded base, about 0·31 mm. in diameter. This organ serves as a holdfast during self-impregnation.

The majority of sexually mature segments examined were found to exhibit self-copulation, so that the various stages of the process could be observed. The outer end of the sac first becomes swollen and is directed antero-ventrally, coming to press against the outer wall of the genital cloaca and the aperture of the male tube is directed towards the female pore, which is now rather wide at its outer extremity. The bulbous part of the sac becomes everted into the vagina through the male aperture which forms a sphincter surrounding it, so that the bulb now lies outside the male pore. This bulb dilates the end of the vagina and holds in its proper position the cirrus, which now becomes fully everted into the female canal. The organ when completely extended, lies parallel with and just antero-ventrally from the basal portion of the sac containing the non-eversible portion of the duct which is no longer coiled. Thus a very long narrow U is formed by the strongly bent organ, one limb being the almost tubular sac, and the other the cylindrical cirrus, the two arms being connected by the bulbous base of the cirrus lying just within the vaginal aperture. The cirrus may extend into the vagina to a length greater than that of the sac. An ejaculation of semen apparently takes place at this time, as in some segments in which the cirrus was fully everted into the vagina, the latter was found to be greatly distended by a compact mass of spermatozoa just beyond the termination of the male duct, the end of the mass remote from the cirrus being large and rounded, while the part towards and adjacent to it was rather tubular and of only slightly larger diameter than the duct of the male organ, suggesting that the whole mass (which measured in one case 1·3 mm. long by 0·35 mm. for the greater part of its length) was ejected at one ejaculation. The vagina became swollen by the injected semen and was as wide as the uterus lying beneath it, the circular musculature of the vaginal wall being obviously stretched by the mass of sperms. In another case the mass was smaller (0·75 mm. by 0·25 mm.) but was similarly placed and somewhat similarly shaped. The relation of the cirrus to the vagina during copulation is shown in figs. 28–33 drawn from whole mounts, as well as in figs. 25, 26, 35, drawn from horizontal, vertical and transverse sections of proglottids. Sometimes the cirrus does not enter the vagina and then appears projecting through the genital cloaca, the bulbous portion lying outside the margin of the segment (fig. 34). In such specimens, the length of the organ, measured in alcohol, was found to vary from 2·6 to 2·95 mm., but with a uniform diameter of 0·15 mm. The length when lying in the vagina, measuring from the tip to the base of the bulb outside the male pore, varied from 1·5 to 1·7 mm., with a diameter of 0·17 to 0·2 mm., usually the latter.

The genital pore alternates irregularly, and is situated about the middle of the segment or just in front of it, but a genital papilla is not pronounced.

The ovary lies at the posterior end of the segment and appears as a compact organ composed of numerous, very short, ovarian lobes, the posterior largely enclosing the shell gland on its ventral aspect, while the anterior partly encloses the receptaculum seminis. There are four main masses constituting the ovary, two dorsal and two ventral, all connected by a short, fairly thick isthmus, more or less hollow and containing free eggs and communicating with the oviduct. These masses are more or less equal and

symmetrical. The ovary extends from the dorsal to the ventral vitelline fields and may be pushed backwardly by the developing uterus so as to invade the succeeding segment. Free ova in the cavity of the isthmus measure about 0·01 mm. in diameter.

From the midventral part of the isthmus arises the oviduct, its point of origin being modified to form a highly developed swallowing apparatus which lies at the base of a short funnel leading from the ovarian cavity (figs. 45, 52–62). Its musculature is strongly developed to form a thick ring of very fine circular and radiating fibres (chiefly circular) surrounding the central aperture. The diameter of the organ is 0·6 mm. It is surrounded by a layer of large cells (probably myoblasts) with prominent nuclei. The part nearest the ovary is much thicker than the distal portion, the wall diminishing rapidly to merge into the muscular wall of the oviduct. The whole organ is very prominent, both in whole mounts and in sections, on account of its dense character and its colouration (yellow to dark brown). It lacks any nuclei apart from the surrounding myoblasts, though some are present in a plug which lies in the distal part of the cavity of the organ. This plug contains ten or twelve nuclei and probably a similar number of cells, whose free surfaces are rather strongly cuticularised, so that the organ may appear stellate. The plug is perforated by a narrow aperture continuous with the cavity of the oviduct. The wall of the duct soon widens though the lumen is not much altered. Its constituent cells are relatively large and on their inner face is a thin cuticle with fairly long cilia or delicate hairs, directed away from the ovary. Surrounding the duct there seem to be some muscular fibres. The oviduct travels ventrally and slightly anteriorly, curving backwardly and then upwards between the posterior limbs of the ovary. Just below the level of the shell gland and at some distance behind the ovarian isthmus, near the middle of the medulla, it receives on its antero-ventral face the narrow fertilising duct to form the ootyp which becomes thrown into a few wide loops below the shell gland and then penetrates the latter posteriorly. Immediately before entering this gland, it is joined by the vitelline duct. The ootyp is now considerably narrowed and travels through the shell gland in a more or less antero-dorsal direction, as a thin-walled tube, emerging at the anterior end of it as a uterine duct or primary uterus. The latter now becomes thrown into a series of coils, its lumen increasing in diameter, but the wall remains thin. These loops lie above the receptaculum seminis and may be seen above part of the ovary also. The various portions of the uterine duct come to occupy a considerable region of the dorsal medulla between the ovary and the secondary uterus. It passes above the posterior part of the latter and above the vagina as a wide tube with numerous short wide pouches, and ultimately becoming narrowed, travels to one side of the vagina to enter the secondary uterus dorsally (figs. 40, 48, 50). This " uterus " is spacious in mature proglottids and lies medianly in the anterior part of the posterior half of each segment. A fairly large, irregularly rounded, uterine aperture is situated ventrally just behind the middle of the organ. The shape of the uterus varies according to the age of the segment and the quantity of eggs present, as one proglottis was seen to possess a large rounded egg-bearing uterus measuring over 3 mm. across by 2·3 mm. in length, while those in segments on either side of it measured 2 by 1·2 mm. and 2·5 by 0·7 mm.

respectively. The mature organ may measure 3 by 2 mm., or it may be practically circular in surface view and occupy most of the medulla of the posterior two-thirds of the proglottis. It seldom extends into the anterior third of the segment, but lies mainly in the middle third, and projecting into the posterior third. It does not extend beyond the excretory canals, though it sometimes reaches almost to them. As already mentioned the egg-laden segments possess a swollen region ventrally due to the size of the fully-developed uterus. The latter possesses a thick epithelium of large, rather narrow, club-like cells with rounded free ends and vacuolate protoplasm. This layer is very obvious in the dorsal, anterior and posterior parts of the organ, but it becomes very thin ventrally where the individual cells are more like comparatively long and very thin squames. Outside the epithelium is a thin layer of longitudinal and oblique or circular fibres. The uterus approaches very closely to the overlying and underlying cortex, so that the longitudinal muscles of the latter are displaced, while the cortex and subcuticula become very thin and a more or less circular uterine aperture appears ventrally near the middle of the organ.

The shell gland lies dorsally and chiefly behind the ovary between its posterior limbs. It lies above the fertilising duct and ootyp, and may extend above the ovarian isthmus and parts of the receptaculum seminis. It is more or less oval, being from 0·3 to 0·4 mm. long by 0·15 to 0·3 mm. broad, and notched posteriorly where the ootyp and vitelline duct join to enter it as the uterine duct on the pore-bearing side of the midline.

Vitelline glands are small and extremely numerous, forming a single layer in the deeper part of the cortex within the longitudinal musculature. They vary somewhat in size, though they generally possess a diameter of about 0·06 mm. They are not limited to the region of the testes but are distributed over the whole segment dorsally and ventrally, except where they are displaced by the egg-laden uterine duct or uterus. The vitelline fields are not interrupted by the genital ducts. The thin-walled common vitelline duct travels posteriorly below the ovarian isthmus beside the oviduct, generally between the latter and the isthmus, becoming widened into a vitelline reservoir, and aventually enters the ootyp just before it penetrates the shell gland.

The outer part of the vagina lies antero-ventrally from the cirrus sac, travelling inwards parallel with it, and at times partly overlapped by it and by some of the coils of the vas deferens. It curves backwardly near the median line of the segment, passes between the coils of the vas, then above the uterus where it is somewhat widened. It follows a slightly curved course above the latter organ, passing on one side of the opening of the uterine duct into the uterus and then becoming practically median in position, immediately above the uterus into whose cavity it, together with the adjacent tissue, may project. In this region it lies between the uterus and the lobes or coils of the overlying uterine duct. Towards the posterior end of the former, it is again displaced laterally and comes to occupy a more ventral position. In the region between the uterus and the ovary it is thrown into a series of close loops whose lumen is generally widened

to form a series of small receptacula seminis. This coiled portion is situated almost transversely and after ascending terminates in a large receptaculum, usually more or less longitudinally placed and pyriform, though sometimes elliptical, with its anterior end lying dorsally to the preceding coils. The main portion is situated above the ovarian isthmus and between the anterior limbs. It may extend beyond the isthmus, while in segments containing a very large uterus, the posterior end of the latter may also be overlapped by it. From its posterior rounded extremity there is given off a very narrow fertilising duct which curves backwardly and slightly ventrally behind the isthmus, closely investing the lower border of the shell gland and soon joining the oviduct.

The cuticle of the outer part of the vagina is covered with minute prickles or spinules like those of the cirrus, while further back, in the vicinity of the uterus, it has abundant, very long, hairs or cilia, 0·01 mm. in length, like those lining the ejaculatory duct, while similar structures are present in the widest coils or loops lying behind the uterus, but are absent from the main receptaculum seminis. Both longitudinal and circular muscle fibres are present in the vagina, though they are poorly developed in its outer region, but are well marked in that portion which lies above the uterus, and externally to the musculature are numerous myoblasts.

Uterine eggs are somewhat elliptical (fig. 67), measuring (in fluid) 0·07 to 0·08 mm. long by 0·033 to 0·037 mm. broad, but with bluntly rounded extremities.

The species is obviously close to *Monorygma perfectum* (Ben.). The status of *Monorygma* is now in some doubt. Southwell (1925, 146) and Fuhrmann (1930, 242) consider it as a synonym of *Phyllobothrium*, but Beauchamp (1905, 506), Linton (1924)*, Meggitt (1924), and Baylis (1932, 400) consider it valid. The well-developed thick bothridia devoid of a crenulate border, the presence of large projecting accessory suckers and the fact that segments reach maturity while remaining attached to the strobila, serve to distinguish *Monorygma* from *Phyllobothrium*, so that I prefer to regard the present species as *M. macquariae* rather than *Phyllob. macquariae*.

Monticelli's (1892) *Ceratobothrium* has a scolex resembling *Monorygma*, both of them possessing large anterior suckers with projecting cornified posterior angles, but the latter are produced into horn-like structures in the former genus. The uterus is not of the type occurring in *Monorygma*, the yolk-glands occupy a very restricted lateral zone, and the ripening segments probably become detached to undergo further development. The genus does not belong to the Onchobothriinae, where it is usually placed, but to the Phyllobothriinae where Fuhrmann (1932, 242) has recently assigned it.

Linton (1924) recorded *Monorygma perfectum* from *Somniosus brevipinna* from Alaska, while Beneden's type material came from the same host species (his *Scymnus glacialis* and *Laemargus borealis* being synonyms of *S. brevipinna*, according to Linton)

*Linton (1924, 16) stated that Diesing erected the new generic name *Monobothrium* for this species—obviously a lapsus for *Monorygma*.

from the Belgian coast. Our species resembles much more closely that described by Linton as *M. perfectum*, than that described under the same name by Zschokke (1888) from *Scyllium* spp., apparently from Naples. Monticelli (1890); (1892) regarded the latter as distinct and named it *M. elegans*, while Beauchamp (1905, 506–7) gave a short account of it, and Linton (1924) pointed out differences between the two. Southwell (1925), however, regarded the two as synonyms and included them, as well as *Monorygma dentatum* Linstow, under *Phyllobothrium perfectum* (1925, 162). *M. dentatum* was based on an immature form taken by the "Scotia" from an undetermined shark in the north equatorial Atlantic. Linstow's figure indicates a form (perhaps a *Phyllobothrium*) quite distinct from *M. perfectum*.

Beneden's original account of *M. perfectum* is not available, consequently comparison has been made with Southwell's abstract and figures from Beneden's account, and with Linton's description. No definite myzorhynchus was seen by Linton or by me, though Beneden figured it and Diesing regarded its presence as a generic character. The scolex is larger than those described by Linton and Beneden. Linton stated that the sex apertures, as well as the cirrus sac, are nearer the anterior border, and Beneden's figure (Southwell 1925, fig. 93*d*) indicates a similar position, whereas in *M. macquariae* they are just in front of the mid-margin. Except in occasional terminal segments nearly all proglottids are broader than long. It is quite possible that this species of *Monorygma* collected from an insufficiently known large subantarctic shark, allied to the Arctic shark, may be synonymous with *M. perfectum* described from the latter.

TETRABOTHRIIDAE.

TETRABOTHRIUS MINUTUS *Szpotanska*.

Synonymy—Tetrabothrius minutus Szpotanska 1917; 1925, 690–1.
Tetrabothrium minutum Fuhrmann 1932, 29.

This slender cestode was represented in four collections from Antarctic petrels, *Thalassoica antarctica*, by Dr. McLean in Adelie Land in 1913. The bottle which contained three of the collections had become damaged, allowing the fluid to escape, so that there remained only dried tangled material in the tubes. In another collection a fragment of *T. minutus* was present in addition to a specimen of *T. magnus*. The dimensions and form of the strobila and the arrangement of the organs in the fragment permit identification with Szpotanska's species based on material taken from the same species of host by the "Valdivia."

Szpotanska (1925) referred to its similarity to *T. monticellii* Fuhrm., but pointed out a number of differences between the two. It might be mentioned that the correct name for *T. monticellii* Fuhrmann (1899) is *Tetrabothrius minor* (Loennberg 1893; 1896)

as Fuhrmann (1899; 1908; 1932, 29) recognised the identity of his species with *Bothridiotaenia erostris* var. *minor* of the Swedish author, though he retained his own name. A varietal name has a nomenclatural status, and hence the name should be *T. minor*.

TETRABOTHRIUS MAWSONI *n. sp.*

(Figs. 68–75.)

Synonymy—Tetrabothrius cylindraceus Leiper and Atkinson 1914, 223; 1915, 48–9, pl. 4, fig. 31, nec. Rudolphi 1819.

Leiper and Atkinson (1915) referred to the presence in MacCormick's skua from the Ross Sea, of a species of *Tetrabothrius*, identified by them as belonging to *T. cylindraceus* (Rud). The account is very brief and, like their figure, is quite inaccurate in several features. As Fuhrmann hinted previously (1921, 523), the identification of this parasite with Rudolphi's species which is known to occur in many species of gulls and terns in the northern hemisphere, is an error, though the Antarctic cestode shows some resemblance to *T. cylindraceus* as well as to *T. erostris*.

The species was obtained at Commonwealth Bay on three occasions, namely, by Dr. Hunter from two specimens of *Catharacta maccormicki* taken in February and March, 1912 (the worms being placed in one tube); and from another by the late Dr. McLean during 1913. The material was only fragmentary. Two of the strobilae were rather long, the larger being 128 mm. Both were devoid of a scolex. Judging from the appearance of the longer fragment, the complete length should be about 150 mm. Detached segments or groups of segments were fairly numerous and exhibited various stages of maturity. Leiper and Atkinson gave the length as 8 cm. and stated that the segments near the anterior end of their fragment were quadrate, about 0·64 mm. broad and 0·47 mm. long. It was such a proglottid that they figured, but the form is very variable, depending on the state of contraction of the powerful musculature. The edges of the strobila project freely, giving a markedly serrate appearance, especially in short contracted proglottids.

The scolex is not sharply marked off from the rest of the strobila. It measures 0·38 mm. in breadth at the level of the auricular appendages and 0·41 mm. near the base of the sickers. The latter are wide and shallow, each measuring 0·28 mm. long by nearly 0·2 broad. The length of the scolex from its apex to the base of the suckers is 0·35 mm. When viewed laterally the suckers are seen to project freely, the scolex having a thickness of about 0·3 mm. in the region of the auricles as well as at the base of the suckers. The appendages are rather small, about 0·17 mm. in length. They project slightly and cover only the most anterior part of the sucker. The suckers of each side touch for most of their length. The scolex resembles that of *T. erostris* in general form. Segmentation begins immediately behind the scolex, and this region is 0·45 mm. broad, its segments being extremely short. The increase in width is gradual, as also is the increase in thickness. Segments become rather longer, with their posterior edges much wider than

the anterior, so that there is a marked serrate margin to the strobila. Such segments increase from 0·20 and 0·24 mm. in anterior and posterior breadths by 0·16 mm. in length; while at about the estimated mid-length of the strobila the dimensions are 1·54 mm. maximum breadth by 0·12 mm. long, then they diminish to 1·40 and 1·60 mm. broad by 0·33 mm. long. Final segments in the strobila are about 1·40 and 1·65 mm. in breadth by 0·70 mm. in length. A sexually mature narrow proglottis which measured 3·57 mm. across the posterior margin, was 0·49 mm. thick; one a little older and containing testes and a ripening uterus was 2·10 mm. across posteriorly, 1·87 mm. wide anteriorly, and 0·88 mm. thick; while a younger, very muscular, proglottid measured 2·4 broad by 0·495 mm. thick. Ripe segments whose parenchyma was largely replaced by the uterus, were found to measure about 1·7 mm. in width by 0·6 in length, such proglottids being already partly emptied of eggs through a well-marked dorsal uterine pore. The general form of sexually mature segments resembles that of *T. cylindraceus* (Linton 1927, fig. 7; Szpotanska 1929, fig. 19; Linstow 1900, 362–4).

The cestode is very muscular. The inner longitudinal bundles contain 16 to 20 very large fibres. The outer longitudinal series consist of about 3 to 6 fibres each. Transverse musculature is well-developed and the dorsal series is in contact with the testes, and in ripening segments with the uterus.

The excretory canals are obvious, the ventral being a little larger than the dorsal. The latter has a thicker wall and a more highly refracting outline. Both sets of canals are provided with a number of well-marked longitudinal and circular fibres. The ventral canals in the posterior half of each segment show the entry of many small canals resembling the condition described by Fuhrmann (1918, 409) for *T. sarasini*, and by Szpotanska (1929, 133) for *T. sulae*—especially the latter. The dorsal canal lies almost directly above the ventral but slightly more inwardly, and their respective diameters in six ripe segments are about 0·02 and 0·015 respectively, though both vary in width somewhat.

The testes are very numerous, there being about 70, distributed chiefly behind the female glands and occupying most of the parenchyma bounded by the excretory canals. In this region they are in two indefinite layers. They also occur at the sides of the ovary, especially on the aporal side, as well as a single row in front of the ovary and yolk glands. They are, moreover, distributed as a single layer above the ovary and part of the shell gland, and also above the early uterus. They may cover part of the vitellarium also. This arrangement above the female glands is unusual in the genus. The testes stain very feebly with haematoxylin, being in this respect in marked contrast with the ovary, uterus and vitellarium. Leiper and Atkinson stated that the testes (15 to 30) occupied the more anterior part of the segment as a deeply staining horse-shoe shaped mass with the concavity facing posteriorly, and their figure indicates such a structure. These authors apparently have not recognised the testes at all, but have really described the deeply staining horseshoe-shaped mass which may be either the

ovary or the developing uterus, more probably the former. The testes are rounded, or elliptical, measuring about 0·05 to 0·07 mm. by 0·05 to 0·065, with a dorsoventral diameter of 0·014 to 0·02 mm.

The vas deferens can be recognised between the shell gland and the poral wing of the ovary. It then passes upwards and outwards above the ovary and developing uterine rudiment and at about the same level as the adjacent testes and immediately below the transverse muscle fibres. Just behind the anterior series of testes it becomes much widened and convoluted, its general direction now being directed laterally. The coils are less numerous after the duct passes outwards between the excretory canals. It then enters the thin, weakly muscular, cirrus sac which is rather elliptical or slightly pyriform, measuring 0·11 mm. in length by 0·09 mm. in transverse diameter. Within it the male duct is considerably coiled, eventually opening into the male atrial canal which is about 0·07 mm. long. The latter opens on a prominent curved conical genital papilla about 0·05 mm. high. This projects into the very large muscular atrium measuring about 0·14 mm. to 0·20 mm. from before backwards in mature proglottids. In some older segments with a fairly well-developed uterus, the atrium was seen as a large sucker-like organ projecting from the margin. It lies slightly in front of the middle of the segment margin on the left side of the strobila, and on account of its huge size occupies very nearly half the length of that region. Leiper and Atkinson gave as its dimensions 0·23 mm. diameter, cavity 0·15 mm.

The ovary is a broad readily-staining horseshoe-shaped organ in the anterior half of the segment. It has numerous short rounded lobes projecting from its surface and its margin. The organ measures about 0·4 mm. across and 0·2 mm. from before backwards. In shorter, more compact segments than that drawn in fig. 69, the testes are much less obvious and the ovary appears more prominent. There is a small oocapt from which the oviduct passes back on a slightly curved course below the shell gland and uterine duct. It becomes considerably swollen to function as a receptaculum seminis. This part meets the vagina and then, as a wide duct, curves backwards, then forwards and dorsally, to enter the shell gland from behind as a very narrow canal. This gland is rounded, 0·05 mm. in diameter, and lies dorsally to the level of the ovary but just below the level of the dorsal layer of testes. The female duct leaves the gland anteriorly and this uterine canal which lies between the ovary and the supra-ovarian testes, soon bifurcates, each limb being at first a narrow cord of tissue passing outwards and backwards, gradually bending more ventrally after passing the ovary and eventually extending laterally between and considerably beyond the excretory canals. As egg development proceeds, the more central part of the uterus becomes swollen into a very lobulate sac covering the disappearing ovary. Much later, eggs become pushed also into the lateral tubular extensions of the organ. Eventually the lobes become larger and come into apposition, so that most of the ripe segment between the excretory canals comes to be occupied by the large sac-like uterus, into whose cavity numerous septa project. By this time a uterine aperture has been formed by the modification of the

uterine "cell strand." The overlying longitudinal musculature has become displaced or interrupted and through this rounded median opening which varies in diameter, eggs must escape since such final or free segments seem to have fewer eggs than one would expect.

The yolk gland is a rather narrow organ with a few small irregular lobes. It lies in the region of the anterior part of the segment, in front of, and just below, the anterior part of the ovary. It may be partly covered by the anterior row of testes. It measures about 0·2 mm. in breadth by 0·02–0·05 mm. antero-posteriorly. Its duct passes below he ovary to join the oviduct before the latter reaches the shell gland.

The vagina travels outward from the receptaculum seminis, above the ovarian wing and just behind the vas deferens and then keeps company with the latter, lying immediately below it as a fairly wide tube. This is more or less straight and serves as a long seminal receptacle. It passes between the vas deferens and the ventral excretory canal and eventually below the cirrus sac. Near the outer end of the latter, the vagina turns in a dorsal direction, entering the muscular wall of the atrium—to terminate apparently at the base of the genital papilla near and just below the male opening. For the greater part of its length the tube has rather thick walls containing muscular fibres and probably gland cells as well.

In a macerated segment, the vagina was seen to lie just in front of the nearly straight vas deferens and then it curved sharply backwards and upwards to enter the atrial musculature. Leiper and Atkinson's statement that the broad vagina crosses the segment and after turning once on itself travels towards the centre, is obviously quite incorrect.

This new species differs from the related cestodes, *T. erostris*, *T. cylindraceus* and *T. sarasini* from Lariform birds, in the dimensions of the scolex and its suckers, in the size of the cirrus sac, and especially in the number and disposition of the testes. The presence of a uterine pore in late segments of *T. erostris* was reported by Nybelin (1922, 203).

The specific name, *T. mawsoni*, is given as a tribute to Sir Douglas Mawson, the leader of the Australasian Antarctic Expedition. The host, *Catharacta maccormicki*, is, par excellence, the bird of the Antarctic coasts (as distinct from the pack ice), as it spends most of its time on or very near the continent and outlying islands, where it preys on petrels during the breeding period, as well as on the eggs and young of the smaller penguins. It also utilises dead animal matter as a food supply.

Railliet and Henry (1912, 38) recorded the presence of *Tetrabothrius* sp. from the related subantarctic skua, *Catharacta antarctica*, from Graham's Land. Their material consisted of fragments, one of them possessing a scolex 0·275 mm. long by 0·38 mm. broad. The maximum width of the strobila was 1·5 mm. No anatomical details were given. Gain (1913, 123) referred to the same occurrence.

TETRABOTHRIUS MAGNUS *Szpotanska.*

Synonymy—Tetrabothrius magnus Szpotanska 1917; 1925, 691–2.
Tetrabothrium magnum Fuhrmann 1932, 29.

In a tube of material taken by Dr. McLean from an Antarctic petrel, *Thalassoica antarctica*, in Adelie Land, in October, 1912, were several fragments of a rather large cestode apparently all belonging to the same specimen. In company with it was a small piece of another species, *T. minutus*. One fragment measuring 95 mm. possessed a scolex. The longest piece, measuring 125 mm., was composed of older segments, while another, 100 mm. long, consisted of the terminal part of the strobila. There were a few other small fragments, the total of all pieces being over 400 mm., just the same length as that recorded by Szpotanska whose material came from the same host species, taken by the "Valdivia." The maximum breadth of the "Aurora" fragments is 3·7 mm., being thus rather wider than the type, while at 20 mm. behind the scolex the width is nearly 1 mm., agreeing with Szpotanska's statement (0·975 mm.). The scolex measured 0·583 mm. broad and 0·46 mm. long. The neck is 0·37 mm. wide. The testes are arranged mainly on the aporal side of the segment, and in a single row in front of and behind the female organs.

TETRABOTHRIUS HETEROCLITUS *Dies.*

Synonymy—Tetrabothrium heteroclitum Diesing 1850, 600.
T. (*Eutetrabothrium*) *heteroclitum* Dies. 1856, 28.
T. heteroclitum Fuhrmann 1899, 1932, 29.
Amphoterocotyle elegans Dies. 1863.
Prosthecocotyle heteroclita Fuhrmann 1899, 182; 1899, 874; 1899, 648–50, figs. 4–8.
Tetrabothrium auriculatum Linstow 1888, 14–15, figs. 18–20; 1900 (1902), 158–160.
Prosthecocotyle auriculatum Fuhrmann, 1898, 388.
Taenia sulciceps Baird 1859, 111, pl. 56, fig. 1.
Prosthecocotyle sulciceps Fuhrmann 1899, 181; 1899, 868; 1899, 642.
Taenia diomedeae Linstow 1888, 13.
Tetrabothrium macrocephalum Monticelli 1889, 324 (in part).
Hymenolepis sulciceps Parona 1899.
Tetrabothrius heteroclitus Railliet and Henry 1912, 38; Leiper and Atkinson 1914, 225; 1915, 47–8; Linton 1927, 10–12, figs. 14–22.
Porotaenia heteroclita Szpotanska 1925, 724.
Porotaenia heterolita Szpotanska 1925, 725.

This widely distributed parasite of albatrosses and petrels has already been recorded from the Antarctic by Railliet and Henry (1912, 38) as having been collected by the "Pourquoi-pas" from *Priocella glacialoides*, *Daption capense* and *Pagodroma nivea.*

Leiper and Atkinson (1914; 1915) identified it from "Terra Nova" material taken from *Puffinus cinereus* (i.e., *Priofinus cinereus*) at 42° S., 111° E. The Challenger obtained it—identified by Linstow (1888) as *T. auriculatum*—from *Priocella glacialoides* in Antarctic waters, and from *Daption capense* off South Africa. The "Aurora" material consists of a scolex and parts of a strobila taken by Dr. McLean from a snow petrel, *Pagodroma nivea*, at Commonwealth Bay in 1913.

TETRABOTHRIUS WRIGHTI *Leiper and Atkinson.*

Synonymy—Tetrabothrius wrighti Leiper and Atkinson 1914, 225; 1915, 53–4, pl. 4, fig. 22.

Tetrabothrius wrighti Clausen 1915, 9–18, figs. 1–5.

Tetrabothrius wrighti Fuhrmann 1921, 531–2, figs. 75–6; 1931, 338, fig. 362, fig. 401.

Tetrabothrius wrighti Szpotanska 1928, 131.

Tetrabothrium wrighti Fuhrmann 1932, 30, fig. 1.

? *Tetrabothrius joubini* Railliet and Henry 1912, 37.

A number of specimens of this minute cestode were collected by the late Dr. McLean from the intestine of an Adelie penguin, *Pygoscelis adeliae*, Adelie Land, in 1913. They are all immature and resemble closely that figured by Leiper and Atkinson. Their length is between 2·0 and 2·8 mm., most of them between 2·0 and 2·3 mm. The powerful, sucker-like auricles are characteristic. There were twelve testes in the oldest segments, fewer in the younger proglottids.

The species has been well described by Clausen (1915) some of whose figures have been reproduced by Fuhrmann (1921; 1931; 1932). Szpotanska (1928, 131) gave a summarised account from the same material as that studied by Clausen. The "Terra Nova" material came from *P. adeliae* from the Ross Sea. Clausen studied the specimens taken by the German Deep Sea Expedition, "Valdivia,"* the host being recorded as *Aptenodytes forsteri*. Fuhrmann, who supplied the material to Clausen and to Szpotanska, recorded the species as having been taken from that species by the "Gauss" in the pack ice in April, 1902.

T. joubini Railliet and Henry, collected from the ringed penguin, *Pygoscelis antarctica*, by the "Pourquoi-pas," is closely related to *T. wrighti* and may be synonymous with it. The material was very badly fixed and apparently abnormally elongate as a consequence, hence the length of 30–40 mm. with a maximum breadth of 0·45–0·5 mm. Mature specimens of *T. wrighti* are stated by Clausen (1915) and Fuhrmann (1921) to be 23 to 25 mm. long, and (maximum) 0·75 mm. broad. Railliet's material possessed 5 to 8 testes; Clausen reported the presence of 6 to 8 in some segments

* The "Valdivia" in 1898 skirted the pack ice to the north of Enderby and Kemp Lands.

examined by him, and Leiper and Atkinson figured a reduced number in the younger segments, just as we have observed in the " Aurora " material. It seems probable, then, that *T. joubini* and *T. wrighti* are the same species, and, if so, the former has priority. Fuhrmann (1932, 187) has, in error, quoted *T. joubini* as having been recorded from *Pygoscelis adeliae* instead of *P. antarctica*. Szpotanska (1925, 723, 725) wrongly included the species amongst the parasites of Procellariiform birds, *Diomedea albatrus*, a North Pacific albatross, being mentioned as the host.

Chaetophallus umbrella (*Fuhrmann*) *Nybelin*.

Synonymy—Prosthecocotyle umbrella Fuhrmann 1898, 388; 1899*a*, 182; 1899*b*, 871; 1899*c*, 642.

Prosthecoccotyle (sic) *umbrella* Szpotanska 1925, 699.

Tetrabothrius umbrella Fuhrmann 1908.

Tetrabothrius umbrellus Szpotanska 1925, 699.

Chaetophallus umbrella Nybelin 1916, 301; 1922, 199–200, fig. 115.

Chaetophallus umbrellus Fuhrmann 1921, 506–9, figs. 88–91; 1930, 196, fig. 230; 1931, 351, fig. 382; 1932, 24, figs. 3*a*, *b*.

Chaetophallus umbrellus Szpotanska 1925, 699–701, figs. 6, 7.

Chactophallus (sic) *umbrellus* Szpotanska 1925, 676.

Chaetophallus musculosus Szpotanska 1917; 1925, 695–9.

? *Chaetophallus robustus* Nybelin 1916, 300–1; Fuhrmann 1921, 505–6, figs. 86, 87; Szpotanska 1925, 694, etc., also 677, etc., as *Chactophallus robustus*.

This cestode has been recorded from several species of albatrosses from the South Atlantic and Southern Ocean; *Diomedea exulans; Diomedea* sp., and *Phoebetria fuliginosa*. Ransom (1909, 61, 108) listed it under *Phoebetria palpebrata*, which he apparently considered synonymous with *P. fuliginosa*, from which Fuhrmann (1908) reported the cestode. Ransom's record from *P. palpebrata* should be eliminated. If *C. robustus* be a synonym, then to the host list must be added the yellow-nosed albatross, *Thalassogeron chlororhynchus*. Fuhrmann (1932, 188) and Szpotanska (1925, 725) listed it under *Diomedea albatrus* from the North Pacific, but I do not know on what authority, and suggest that it is probably due to an erroneous entry.

The " Aurora " collection contains a few very small fragments, without scolex, taken from the giant petrel, *Macronectes giganteus* in Commonwealth Bay, Antarctica, by the late Dr. McLean in 1913. The anatomy is typical, the characteristic course of the widened vagina being very evident. The bird has a wide distribution in the southern hemisphere, ranging from the Tropic of Capricorn to the Antarctic Continent (in summer).

A macerated immature strobila, 70 mm. long, taken from *Thalassoica antarctica* in the same locality as the material from the giant petrel, is also assigned to *C. umbrella*. The characters of the scolex agree sufficiently closely with those described for the species, and the genital ducts are of the *Chaetophallus* type.

This is the first record of the parasite in the Antarctic. The name *umbrella* is used in preference to *umbrellus*, which is more commonly employed, as it is not an adjective but the diminutive of a substantive.

DILEPIDIDAE—DILEPIDINAE.

PARORCHITES ZEDERI (*Baird*) *Fuhrmann*.

Figs. 76–93.

Synonymy—Taenia zederi Baird 1853*a*, 85–6; 1853*b*, 24, pl. 31, fig. 2; 1855, 75–6; Diesing 1864, 417.

Taenia cederi Krefft 1871, 211.

Tetrabothrius macrocephalus (Rud.) Monticelli 1891, 158 (in part).

Prostheocotyle macrocephala (Rud.) Fuhrmann 1899*a*, 873; 1899*b*, 182 (in part).

Tetrabothrium zederi Linstow 1900, 365.

Tetrabothrium zederi Fuhrmann 1899, 642.

Hymenolepis sp. Rennie and Reid 1912, 449–50.

Anomotaenia zederi Railliet and Henry 1912, 35–37; Gain 1913.

Anomotaenia zederi Leiper and Atkinson 1914, 222; 1915, 54–55, fig. 11, pl. 4, figs. 23, 24.

Anomotaenia zederi Clausen 1915, 47–62, figs. 21–33.

Anomotaenia zederi Fuhrmann 1921, 513–5, figs. 99–102; 1931, 397, fig. 428.

Parorchites zederi Fuhrmann 1932, 112, fig. 84.

There are six collections represented amongst the material, all taken from the intestine of the emperor penguin, *Aptenodytes forsteri*. Three were made by the late C. T. Harrisson on the Shackleton Glacier (Ice Shelf) and in the vicinity of the Western Base, Queen Mary Land, probably in the summer, 1912–13. Of the remainder, two were made by Dr. J. G. Hunter in October, 1912, in the vicinity of Commonwealth Bay; while the third was collected by the late Dr. A. L. McLean during the eastern coastal sledging journey. This last-mentioned material was taken apparently on 15 December, 1912, as there is a reference in Mawson's "Home of the Blizzard" (Vol. 1, p. 332) to McLean finding "the stomach (of an emperor penguin) full of fish and myriads of cestodes in the intestine." Mawson's map shows that the position reached on that date was on the solid floe ice to the east of the Ninnis Glacier Tongue and about 149° E., 68° S.

All collections are represented mainly by pieces of the intestine studded with the characteristic cysts which the parasite causes to form as obvious rounded white swellings projecting on the peritoneal surface of the digestive tract. The species has been collected by many expeditions which have entered Antarctic waters. It was originally described in a few lines by Baird (1853*a*) who mentioned that headless fragments from the stomach of a penguin were presented by the Admiralty to the British Museum. In other publications (1853*b*; 1855) he stated that the material had been collected in the Antarctic seas during "the late Antarctic expedition." *Bothriocephalus antarcticus* taken from a seal in the region of the Antarctic Circle by that expedition, was described in the same publications. These facts indicate that the material was collected during the Ross Expedition ("Erebus" and "Terror" 1841–3). Leiper and Atkinson (1915, 57) definitely listed the two named cestodes as having been brought back by that expedition. It was next taken by the "Valdivia" (1898–9) from *Aptenodytes forsteri*, though not identified until 1915, when Clausen recognised it. The "Scotia" (1902–3), "Gauss" (1901–3), "Pourquoi-pas" (1908), and the "Terra Nova" expeditions all collected the species in that portion of the Antarctic visited by the particular expedition.

The synonymy of this cestode is rather formidable and the worm has been included under no less than six different genera. In 1899 Fuhrmann (1899*a*, 873; 1899*b*, 182), following Monticelli (1891, 158), regarded it as a possible synonym of *Prosthecocotyle* (i.e., *Tetrabothrius*) *macrocephala* (Rud.), a parasite of Colymbiform birds in the northern hemisphere. The host was listed as *Aptenodytes* sp. Later, this author stated that such identification was an error (1921, 523). The best accounts are those of Clausen (1915) and Fuhrmann (1921), the former publishing many figures relating to its anatomy, his material having been obtained by the "Valdivia" and the "Gauss."

The external view of the typical cysts is indicated by Fuhrmann (1921, pl. 56, fig. 3), and their appearance when cut open is figured by the same author (1921, 514, fig. 100; 1931, 397, fig. 428). The cyst has been described by Railliet and Henry (1912, 36–7) and referred to by Clausen (1915, 47–8), Leiper and Atkinson (1915, 55), and Fuhrmann (1921; 1931).

Railliet and Henry stated that a great number of the penguins (*Pygoscelis papua* and *P. antarctica*) examined during the French Antarctic Expedition*, were found to be parasitised by this cestode and that the host name generally quoted, *Aptenodytes* sp., was based only on Baird's remark that his species came from an Antarctic penguin. Diesing (1864, 417) seems to have been the first to quote *Aptenodytes* sp. as the true host, and Linstow in his Compendium der Helminthologie (1878) followed him. It may be pointed out that no expedition—excepting the French and the Scottish—collected the species from any penguin except the emperor, *Aptenodytes forsteri*. Rennie and Reid (1912)

* Gain (1913, 46, 48, 56, 60, 61), in his account of the birds of the second French Antarctic Expedition, referred to the occurrence of abundant cysts of cestodes (*Anomotaenia zederi*) along the intestine of *Pygoscelis papua* and *P. antarctica* (Petermann Island and Deception Island).

reported that the "Scotia" material came from the ringed penguin, *Pygoscelis antarctica*, from the South Orkneys. Railliet and Henry mentioned that the cysts were found during the French Expedition in many *Pygoscelis papua*, and at times in *P. antarctica*, but never in *P. adeliae*.

Penguins form a very important part of the diet of those who visit the Antarctic seas and coasts, the Adelie penguin, *P. adeliae*, being especially common, and yet no other specimens of *P. zederi* have been brought back which had been taken from *Pygoscelis* spp. The recent British, Australian and New Zealand Antarctic Expeditions ("Discovery") of 1929–1930 and 1930–1931, failed to reveal any examples from the Adelie penguin and the gentoo (*P. papua*), though the author specially examined a number of these birds, whereas *A. forsteri* commonly had them.

In his account of the birds of the South Orkneys, where the "Scotia" wintered (Scotia Bay), W. E. Clarke (Scientific Results of the "Scotia," 4, (2), 219–247) referred to the common presence of *Pygoscelis adeliae* and *P. antarctica*. Amongst the other birds mentioned by him one notes typically Antarctic forms such as the snow petrel, whereas others belong to the subantarctic, e.g., sheathbills (*Chionis*), cormorants (*Phalacrocorax*) and skuas (*Catharacta antarctica*). He stated that *Pygoscelis papua* also occurred there, but that this locality was near its southern limit. The South Orkneys, South Shetlands and Graham's Land region where the French, Belgian, Swedish and Scottish expeditions worked, show some admixture of antarctic and subantarctic bird, seal and fish life, whereas in the other regions the two zones are definitely separated by a wide ocean. It seems probable that the species infests *Pygoscelis* spp. other than *P. adeliae*, in the Graham's Land—South Orkneys area, but not elsewhere.

As mentioned by Clausen and by Railliet and Henry, the cysts may reach a centimetre in diameter, though most of them are rather smaller. The wall varies between 0·5 and 1 mm. in thickness. They may be more or less buried in the intestinal wall, but may project freely and be connected with the latter by a stalk-like portion.

Gain (1913) thought that the cysts were cysticerci of a species of cestode which reached its adult stage in seals, but Railliet and Henry disagreed with the view, having found the adult cestodes associated with the cyst. Clausen (1915, 49) mentioned that if Gain were correct it would be necessary to admit that seals fed on penguins. As a matter of fact, one species of seal common in the pack ice and in antarctic and subantarctic coastal waters, viz., the leopard seal, *Hydrurga leptonyx*, very commonly feeds on the smaller penguins of those seas, the author having taken parts of Adelie, gentoo, and rock-hopper penguins from amongst the stomach contents.

One to six, perhaps more, cestodes may extend from the cyst into the lumen of the intestine, while commonly more may be seen projecting. Many cysts were found to be devoid of parasites. The portion within the cyst is considerably modified to form

a more or less distorted pseudoscolex due to a spindle-shaped widening of the neck region, at the upper end of which in favourable specimens the small scolex is to be seen. The latter is not marked off and appears merely as the anterior end of the worm, on which the four suckers, the powerful rostellum and the crown of small hooks are situated. The suckers measure 0·17 to 0·2 mm. in diameter; the rostellum is a strong muscular organ more or less rounded or pyriform. Its hooks are arranged in two series of nine each, and measure 0·085 to 0·095 mm. and 0·098 to 0·11 mm. in length respectively. The form of the posterior root varies, being similar to those indicated in Clausen's fig. 26. The diameter of the scolex at the level of the posterior border of the suckers in our specimens is about 0·6 mm. Clausen and Fuhrmann reported it to be 0·8 mm. The largest worm was 73 mm. but was devoid of a scolex, though the swollen neck was present, the complete length probably being less than 75 mm. Railliet and Henry mentioned 5 to 8·5 cms. as the full length; Clausen 6 to 7 cms.; Leiper and Atkinson 4 to 5; Fuhrmann 7 cm.

The varied form of the neck region is shown in the accompanying figures. The maximum breadth of this portion, which is more or less circular in section, varied from 2·0 to 3·2 mm. Traces of segmentation are visible laterally in some specimens in that portion lying within the cyst. As the parasites pass through the neck of the latter they are constricted more or less markedly (0·3—0·5 mm. diameter). Segmentation becomes obvious soon after emergence from the cyst, and rudiments of the ovary are early recognisable—at first approximately median but soon they begin to diverge toward one or other side to occupy their final positions.

The maximum breadth (5·5 mm.) of the strobila is reached some distance in front of the end of the parasite where the width is about 3·5 mm., the segments being not only narrower but slightly longer than those further forward. Clausen reports the maximum and final breadths as 6 mm. and 4 mm. respectively; Railliet and Henry mentioning 5·5 mm. as the maximum. The posterior part of each segment overlaps the succeeding one considerably except in the terminal region where the degree of covering is much less. These overlapping portions are strongly muscular. The sex openings alternate irregularly and are surrounded by a prominent circular raised area which is not overlapped so extensively as the rest of the segment. The presence of this large genital papilla led Monticelli (1891, 158) to place the species under *Tetrabothrius* as a synonym of *T. macrocephalus*. The aperture leads into an extensive atrium at the bottom of which enter the male and female apertures.

Calcareous corpuscles are large and extremely abundant in the cortex where they may form a dense, almost continuous, layer. The dorsal excretory canal is very small and lies close to, but dorso-laterally from, the large ventral vessel which is thrown into numerous undulations. The sex ducts pass above them; the transverse vessel has the usual position. The longitudinal musculature consists of numerous bundles arranged in an outer and a more powerful inner series, in addition to those in the subcuticular region.

The characteristic arrangement of the genitalia which led Fuhrmann (1932, 111–2) to create a new genus for the species, is figured by Clausen (1915, fig. 30–33), and by Fuhrmann (1921, fig. 102; 1931, fig. 84). The testes are very small and numerous—at least 60 to 80 (Clausen, up to 100), arranged in a narrow zone across the more anterior part of each segment, the band sometimes extending a little more laterally towards the pore-bearing side. They lie slightly behind the level of the ovary and a few of the most laterally placed vesicles may be situated behind that organ and the vitellarium. The testicular zone is more or less overlapped by the large posterior projections of the preceding segment. The glands, on the whole, occupy a region in the middle more dorsally than the ovary. The vas deferens becomes thrown into numerous convolutions or loops, occupying a considerable elongate region antero-laterally from the outer part of the ovary and antero-dorsally from the vagina. It enters the rather short, very muscular cirrus sac, which measures about 0·15 mm. The cirrus is about 0·7–0·8 mm. in length and has well-developed longitudinal muscle fibres. The total length of the sac plus the fully extended cirrus is 0·22 mm.

The strongly curved ovary is placed anteriorly quite near the pore-bearing margin and is located in front of the testicular zone. It lies ventrally from the vas deferens, receptaculum seminis, shell gland and testes. The oviduct has a somewhat twisted course after joining with the receptaculum and becoming surrounded by the cells of the shell gland. The vitellarium is very small and compact, lying between the wings of the ovary which project posteriorly. Its duct is very short.

The vagina leads inwards from the female pore just behind the male aperture and curves ventrally below and behind the cirrus sac and vas deferens, becoming widened into a rather long, fusiform, receptaculum seminis dorsal to the ovary and just behind the main mass of that organ. It narrows and then joins the oviduct just laterally from the yolk gland and shell gland. It has a strongly cuticularised wall.

The uterus extends inwards from the ovary as a narrow, more or less tubular structure near the anterior border of the segment. This becomes sacculate and eventually fills the proglottis. The oncosphere measures 0·024–·030 mm. long by 0·020–·026 mm. broad, with hooklets 0·012–·013 mm. long. The inner egg-shell is ·034–·040 mm. by ·027–·033 mm., and the outer 0·045–0·055 by 0·033–0·038 mm.

ANOMOTAENIA DOMINICANA (*Railliet and Henry*).

Synonymy—Choanotaenia dominicana Railliet and Henry 1912, 37–8.
Ictërotaenia dominicana Baer 1925.
Paricterotaenia dominicana Fuhrmann 1932, 110.
(?) *Anomotaenia antarctica* Fuhrmann 1921, 512–13, figs. 97–8; 1932, 90.

This species was not represented in the material collected by the "Aurora," but a few remarks relating to it may not be out of place in this report.

From *Larus dominicanus* two species of cestodes, in addition to *Aploparaksis larina*, have been described, viz., *Choanotaenia dominicana* Railliet and Henry 1912, and *Anomotaenia antarctica* Fuhrmann 1921. The former was taken by the "Pourquoi-pas" (locality not mentioned) and the latter by the "Gauss," the correct locality being Kerguelen and not the pack ice, as Fuhrmann's reference suggests. *C. dominicana* was transferred to *Paricterotaenia* by Fuhrmann (1932, 110) the authors being given in error as Railliet and Lucet. The original account is brief and unfigured and is based on fragmentary material. The only difference between the two genera *Paricterotaenia* and *Anomotaenia* is the presence of a single crown of hooks in the former and a double crown in the latter.

A comparison of the short description of *P. dominicana* with the more detailed account of *A. antarctica* indicates that the dimensions of the strobila (allowing for differences associated with fragmentation in the case of the former) and scolex agree. Both have a well-developed rostellum; very short neck; and a well-marked strongly convoluted vas deferens. Railliet and Henry's account does not allow further comparisons, though they stated that their species was very close to *Choanotaenia* (i.e., *Paricterotaenia*) *rhynchopis* Fuhrmann from a South American skimmer, a group of Lariform birds related to terns. The only difference of importance between the two species from the Dominican gull is the presence of 20 hooklets, 0·034 to 0·036 mm. long, arranged in two rows in *A. antarctica*, and of 10 hooklets grouped in (?) one row and measuring 0·030 to 0·036 mm. in length in *P. dominicana*. The range in the length in the latter case suggests the presence of two circlets and the authors themselves were not certain that there was only one. The hook sizes in the two species are then practically the same, and the only difference is the presence of 20 in Fuhrmann's species and 10 in the other, which was, however, represented by fragmentary material. It seems probable that Railliet and Henry's form is really an *Anomotaenia* with 20 hooks normally, and the Fuhrmann's material belongs to the same species.

HYMENOLEPIDIDAE.

Aploparaksis larina *Fuhrmann.*

Synonymy—Aploparaksis larina Fuhrmann 1921, 518–20, figs. 114–117.

Aploparaksis lari Fuhrmann 1921, 525.

Haploparaxis larina Fuhrmann 1932, 145.

A few dried headless cestodes collected by H. Hamilton from a black-backed gull, *Larus dominicanus*, at Macquarie Island, were treated with alcohol and glycerin. Subsequent examination showed that they belonged to Fuhrmann's species based on material taken from the same species of gull by the "Gauss" Expedition. The locality of the latter is given as "Winter Station" 23 November, 1902; i.e., the drifting pack ice in which the ship was held fast for many months. This is an obvious error as the

bird does not enter the pack ice, its range extending from the subantarctic islands northwards to South America, South Africa and New Zealand. The material must have been collected by the German Antarctic Expedition during its stay in Kerguelen where the bird is very common. The same remark regarding mistaken locality applies also to *Hymenolepis querquedulae* from the duck, *Querquedula eatoni*, and to *Anomotaenia antarctica* from the Dominican gull, the correct locality being Kerguelen.

The identification of this delicate cestode from Macquarie Island has extended considerably its known range.

TAENIIDAE, ETC.

TAENIA *spp.*

At the conclusion of his paper on the cestodes collected by the "Gauss," Fuhrmann (1921, 524) mentioned the various genera recorded from the South, especially Bothriocephalids (*Diphyllobothrium*) and Tetrabothriids, and went on to state that representatives of certain other widely distributed genera also occurred there, viz., *Choanotaenia* (i.e., *Paricterotaenia*), *Anomotaenia*, *Aploparaksis*, *Hymenolepis* and *Taenia*, together with *Mesocestoides* and *Oriana*. The last-named, now regarded as synonymous with *Tetrabothrius*, has not, as far as I know, been recorded from any locality south of the northern end of New Zealand, though it must occur in the Southern Ocean where its host, the Seiwhale (Rudolphi's rorqual), *Balaenoptera borealis*, ranges during the summer. *Mesocestoides* will be referred to later when dealing with one of the species of *Taenia*. Of the remaining five genera, the first four have been recorded from subantarctic localities, *Anomotaenia zederi*, the antarctic species, having been transferred to *Parorchites*. Fuhrmann mentioned in his list three species of *Taenia*,—*T. magellanica* Monticelli *T. antarctica* Fuhrmann, and *T. diaphoracantha* Fuhrmann. These records will now be examined.

TAENIA MAGELLANICA *Monticelli* (1889, 325).

This was described from an unknown host in Magellan Straits. The description is of no value. The genital orifices are stated to be lateral and difficult to recognise, yet the figures show very definite genital openings in the midline at the end of the first fourth of each segment. The illustrations allow one to identify the species as a *Mesocestoides*. The genital aperture is rather far forward for *M. litteratus* Goeze, or *M. lineatus* Batsch (if the latter be distinct). Muhling (1898, 108) had already transferred Monticelli's species to that genus. Another species of *Mesocestoides* has been recorded from the same region, Tierra del Fuego, by Lonnberg (1896, 3), who described *Ptychophysa* (*Taenia*) *michaelseni* from Azara's fox, *Canis azarae*. *M. michaelseni* is very close to, if not identical with, *M. litteratus* and a re-examination of *M. magellanicus* (Monticelli) would probably reveal that *M. michaelseni* was a synonym of the latter, and that both belong to *M. litteratus*.

The Fuegian land fauna is merely a southern extension of the South American. The marine life, including the sea birds, is much more definitely related to southern oceanic and subantarctic forms.

TAENIA DIAPHORACANTHA *Fuhrmann.*

This species was described very briefly by Fuhrmann (1908, 68–9) as having been collected from *Catarrhactes chrysocome* Forster, from the southern coast of South America. The host is a penguin commonly known as the rockhopper, *Eudyptes chrysocome*, syn. *E. cristata*. The species is common on the subantarctic islands, Falklands and Patagonia, extending northwards in winter (Alexander 1928). In his recent work Fuhrmann (1932, 167) listed only three species of *Taenia* (s. str.) as occurring in birds. Apart from these, the genus is restricted to mammals. The larva of this genus has not been found in any marine animal, as far as I know. The rockhopper, like other penguins, obtains all its food in the sea, utilising fish, crustaceans and cephalopods. It is, then, difficult to imagine how such a bird could become infected with any species of *Taenia*. With the exception of *Parorchites zederi*, all other recorded cestodes of penguins belong to the Tetrabothriidae. It seems probable that some mistake in labelling must have occurred, and it is suggested that the parasite belongs to some South American carnivore, probably one which frequents the same region as that inhabited by penguins. Amongst such mammals Azara's fox (*Canis azarae*) or one of the wild cats, e.g., the pampas cat, *Felis pajeros* (*F. pampana*), would be likely hosts. I have already pointed out that the record of *Diphyllobothrium pygoscelis* from penguins (*Pygoscelis*) is incorrect and that the true host is a sea leopard.

There is nothing in Fuhrmann's original account, apart from the host name, to contraindicate the view that it is a mammalian parasite. The measurements have been compared with those given by Hall (1919) and by Baylis (1929) for the species of *Taenia* from the domestic dog and cat. The hook sizes are practically the same as those of *T. antarctica* Fuhrmann, but the latter has rather more uterine branches. *T. krabbei* has the same dimensions of ripe segments and hooks, similar form of the small hooks, and the same number of uterine branches, but this species is restricted to the cold northern regions. *T. ovis* has hooks of similar sizes, but has more numerous uterine branches. *T. pisiformis*, *T. taeniaeformis* and *T. hydatigena*, the last named from cats, all show several characters similar to *T. diaphoracantha*. These three have similar, but larger, hooks than the last-named, though the lower limits in the case of *T. hydatigena* are only slightly in excess of those of Fuhrmann's species but the hook differs slightly. *T. taeniaeformis* has more numerous uterine branches.

The anterior uterine branches in *T. diaphoracantha* give off lateral branches near the anterior end of the segment and these are directed anteriorly, thus lying parallel with the lateral border. *T. taeniaeformis*, *T. hydatigena* and *T. pisiformis* all show this feature, as also does *T. ovis*.

T. diaphoracantha is then very closely related to *T. pisiformis*, *T. hydatigena* and *T. krabbei*, especially the two latter.

TAENIA DIAPHANA *Fuhrmann.*

Though not related to the subject matter of this report, it might be mentioned that of the remaining two species of *Taenia* s. str. recorded from birds, one is *T. diaphana* Fuhrmann (1908, 67–8) from *Rhynchops intercedens* from Brazil. The host is a black skimmer or scissor-bill (*Rhynchops nigra intercedens*), related to the terns. These birds have a peculiar method of feeding and their food is aquatic and not likely to harbour the typical larval stage of a *Taenia*. It seems most probable, in this case, as in *T. diaphoracantha*, there has been a mistake in the labelling. The dimensions and characters given by Fuhrmann suggest that the parasite may be one of the carnivore tapeworms, perhaps *T. hydatigena*, though the number of uterine branches is said to be less in the latter. Hall (1919, 28) stated that the number of such lateral branches found by him in that species was considerably more than generally recorded.

TAENIA ANTARCTICA *Fuhrmann* (1921, 520–22, figs. 118–123).

This species was collected from sledging dogs belonging to the "Gauss," the material being obtained on two occasions while the ship was in the pack ice. These dogs had been fed during the voyage only on seal flesh, penguins and stockfish. Fuhrmann thought that the intermediate host would probably be found in one of these, assuming that the dogs had not brought their parasites with them from Asia. The latter suggestion was not regarded as likely since the species did not agree with any of those already known from dogs. The only mammals in the Antarctic are seals and cetaceans, both carnivorous and feeding exclusively in the sea, and in both groups the genus *Taenia* is unknown, as is also its larval stage, the larval forms recorded as *Taenia* spp., from these two groups all belonging to the Phyllobothriidae. The species can be dismissed as an antarctic form. The dogs must have been infected prior to entering the Antarctic. They were brought originally from Asia. The species seems to be related to *T. krabbei* and *T. ovis* in regard to dimensions of the strobila, and number and size of hooks. The number of uterine branches in *T. antarctica* lies between the ranges given for the two, and does not coincide with either. There are also more testes than in these two, the number approximating that in *T. pisiformis*, but the latter has much larger hooks. The form of the hooks is different from that of *T. ovis* and rather more like that of *T. krabbei*. All these species have very prominent genital papillae. A detailed account of *T. krabbei* is not available to the writer, but the facts available suggest that *T. antarctica* is a synonym of it. The arctic and subarctic distribution of this species of cestode and of the sledging dogs (Eastern Siberia)* supports the view.

If the foregoing views are correct, then adult Cyclophyllidea are represented, as far as yet known, in the true Antarctic only by a member of the Dilepidinae—*Parorchites zederi;* and by several species of Tetrabothriidae in birds and cetaceans;

* Drygalski, in his popular account of the "Gauss" Expedition, mentioned that the dogs were obtained in Kamtchatka and taken to the Antarctic via Hong-Kong, Sydney and Kerguelen.

while the Pseudophyllidea are represented by Diphyllobothriidae (*Diphyllobothrium* and *Glandiceps*) in seals, the larval stages occurring in fish and probably crustaceans. The Tetraphyllidea are represented by larval stages in seals and fish.

Remarks on some previous Records of Southern Cestodes.

Leiper and Atkinson have allowed some obvious errors to appear in their papers (1914; 1915). They stated that *Oriana wilsoni* (a cestode) and *Kathleena scotti* (a nematode) were found within the Antarctic circle (1914, 223; 1915, 59), but in the accounts of these two parasites they are mentioned as having been taken from *Balaenoptera borealis*, Bay of Islands, New Zealand (1915, 46) and *Diomedea melanophrys* from 52° 20′ S., 167° 30′ E., near the Campbell Islands (1915, 24) respectively, these being the correct localities. A cestode, *Monorygma dentatum*, described by Linstow (1907, 470) as having been taken by the "Scotia" from an unknown shark in the north equatorial Atlantic, 9° 23′ N., 25° 31′ W., is listed amongst parasitic nematodes (1915, 57*).

Leiper and Atkinson (1915, 20, 55–6, pl. 5, fig. 35) referred to the presence of small larval *Tetrarhynchus* sp. and larval nematodes encysted in the wall of the caecum of a barracouta, *Lepidopus caudatus*, taken in the Bay of Islands, New Zealand. In another place (p. 59) the host is quoted only under the scientific name. The barracouta, a very common fish in the waters of New Zealand and the southern coasts of Australia, is *Thyrsites atun* Euphr. It somewhat resembles *Lepidopus caudatus*, and both of them belong to the Trichiuriformes, but MacCulloch in his "Check-list of the fishes of New South Wales" (1922) puts them in two separate families. The parasites mentioned by Leiper and Atkinson occur commonly in the outer tissues of the digestive tract of the barracouta in the coastal waters of New South Wales, Tasmania, Victoria, South Australia and Western Australia.

Lepidopus caudatus occurs in the warmer European waters and has been recorded from South Africa, Australia (uncommon) and New Zealand, being known as the frost fish in the last-named region. The "Terra Nova" collection contained both species taken in the north of New Zealand†. In view of the evidence, it seems that the host was more likely to be the more common barracouta, *Thyrsites atun*, rather than the frost fish, *Lepidopus caudatus*. Leiper and Atkinson's figure indicates that the parasite is a *Nybelinia* sp., while that figured as *Abothros carcharias* is now known as *Tentacularia carcharias*. Dolltus (Mem. Soc. Zool. France, 29, 1930, 179–80) stated that Leiper and Atkinson's form was not a larva, but a young adult of a *Tentacularia*, perhaps *T. coryphaenae*.

Baylis (1932, 407) quoted Baer (1932, 224) as stating that "*Balaena antarctica*" was a host for *Priapocephalus grandis*. Baylis indicated the host as *? B. australis*, which is the almost-extinct southern right whale. Baer's host suggests that he meant an

* Stiles, C., and Hassall, A. Index Catalogue of Medical and Veterinary Zoology. Cestoda. Hyg. Lab., U.S.A. Bull. 85, 1912, 276, incorrectly quote "Antarctic" as Linstow's locality; as also do Baylis (1919, 422) and Fuhrmann (1921, 523).

† Regan, T. Fishes. Brit. Antarct. ("Terra Nova") Exp. Nat. Hist. Rep., 1 (1), 1914, 16.

antarctic baleen whale, referring probably to the records of Nybelin (1922, 198) and Baylis (1926, 161) of this cestode from species of rorquals, *Balaenoptera* spp., in far southern waters.

Fuhrmann (1921, 522–3) gave a list of "Antarctic cestodes (adult) from birds and mammals," listing 28 and 15 species of these parasites respectively. The term Antarctic as used by him is unfortunate, as four of the species from mammals and most of those from the birds mentioned, have not been recorded from the true Antarctic. Many of them have been taken in the Subantarctic, though in some cases the host may range into the Antarctic during summer and their parasites may eventually be taken there. Other records relate to findings in the temperate, or even tropical, regions. I use the term Antarctic for the Antarctic continent and for that part of the Southern Ocean which is covered with pack ice during winter—the real "Südliches Eismeer." The Challenger Society* in its map of the area of marine distribution regards 60° S. as marking off the Antarctic Ocean from the Southern Ocean. An isotherm would probably be a more useful boundary for both Antarctic and Subantarctic. The Subantarctic is rather more difficult to define, but its northern limit corresponds more or less with the northern limit of drifting ice, though some of the islands to the south of New Zealand are commonly included also. The fact that many of the oceanic birds range from the temperate portion of the Southern Ocean to the pack ice or even southward from it during summer, and some of them even nesting on Antarctica, makes it difficult to draw up a satisfactory list. Reichenow (1908, 54) as a result of his studies of the distribution of southern oceanic birds, drew a map to represent the "South Polar Zone," which is marked off by a line passing from near Macquarie Island westwardly, eventually trending just north of St. Paul and Amsterdam Islands in the Southern Indian Ocean, thence just north of Kerguelen, Crozets, Prince Edward I., Marion I., Bouvet I., and South Georgia, thence south of the Falklands and Cape Horn. Its extension westwardly in the Subantarctic portion of the Pacific zone is merely indicated. His "south polar zone," an unsuitable name as it extends so far northward from the true south polar region, corresponds fairly closely with my combined Antarctic and Subantarctic zones, except for the extension northward from Kerguelen into the South Indian Ocean.

If we include only those hosts from which cestodes have been collected in the true Antarctic region, then we must remove from Professor Fuhrmann's mammalian list (using the names which he has employed) *Taenia magellanica*, *Mesocestoides michaelseni* (both from the Fuegian region of South America), and *Oriana wilsoni*, which was taken in Northern New Zealand and not in the "southern ice-ocean." Amongst the included tape-worms listed from birds, the following were recorded by Nybelin from the tropical South Atlantic off Angola—*Tetrabothrius fuhrmanni*, *T. skoogi*, *T. gracilis*, and *Chaetophallus robustus*; and the following were collected from oceanic birds in the region between Cape Colony and Tristan da Cunha—*Tetrabothrius campanulatus*, *T. intermedius*,

* Science of the Sea. Edit. G. H. Fowler. London. 1913. Chart 8.

and *T. filiformis*. *T. lutzi* was recorded from Santos in Southern Brazil; and *T. eudyptidis* from Tierra del Fuego. The following were taken in Kerguelen—*Choanotaenia chionis*, *Anomotaenia antarctica*, *Hymenolepis querquedula*, *Hym. chionis*, *Aploparaksis lari*.

I have given reasons for rejecting *Taenia diaphoracantha* and *Taenia antarctica*, while *Dibothriocephalus pygoscelis* is a synonym of one of the mammalian parasites. *Choanotaenia dominicana* is essentially a Subantarctic cestode and most of the remaining species listed from oceanic birds were taken in the Southern Ocean south of a line joining South Africa and Australia.

Fuhrmann (1921, 502, 506) recorded *Tetrabothrius pseudoporus* and *Chaetophallus umbrella* from "*Diomedea* sp., Winterstation, 25th January, 1903" ("Gauss"). Szpotanska (1925, 699, 701) recorded *C. umbrella* from *Albatros* sp. collected by the "Gauss" Expedition on 25th January, 1903. Since Szpotanska's material came from Fuhrmann, it can be assumed that the two authors were referring to the same collection. A search through the reports on the birds observed or collected by that expedition has revealed that Werth (1931, 583) collected "Albatros, *Diomedea* (*Phoebetria*) *fuliginosa*" in Royal Sound, Kerguelen, on 25th January, 1903, and found cestodes in it—in fact, it is the only albatross in which he recorded the finding of any parasites during the expedition's stay in Kerguelen.* It is obvious, then, that *Albatros* sp. of Szpotanska and *Diomedea* sp. of Fuhrmann (1921) refer to the sooty albatross, *Phoebetria fuliginosa* (which breeds on Kerguelen) and that the true locality is not "Winterstation," but Kerguelen.

If, then, we retain from the list of 43 parasites only those actually recorded correctly from the Antarctic (up to 1921), there would remain ten from mammalian hosts,—the Ross, Weddell and leopard seals—*Diphyllobothrium perfoliatum*, *quadratum*, *scotti*, *scoticum*, *lashleyi*, *archeri*, *rufum*, *wilsoni* and *mobile*, and *Glandicephalus antarcticus*. Amongst the bird cestodes there would remain only *Tetrabothrius heteroclitus* (from *Pagodroma*), *T. joubini*, *T. wrighti* (if distinct from the last-named), *T. cylindraceus* Leiper and Atk., nec. Rud, and *Parorchites zederi*, i.e., four or five parasites,—one from a petrel, two or three from penguins, and one from a skua.

Subantarctic records would include the five described by Fuhrmann from Kerguelen birds, together with the two mentioned above from the sooty albatross from the same region, also *Paricterotaenia dominicana*, as well as some species from oceanic birds, and one or two from penguins and one from the sea elephant. Fuhrmann has pointed out (1921, 523) that only one species of cestode, viz., *Tetrabothrius heteroclitus* (*T. cylindraceus* from the true Antarctic skua, *Catharacta maccormicki*, being regarded

* Werth (1931) also mentioned finding cestodes on two occasions in the sheathbill *Chionis minor* (p. 558), once in *Anas eatoni* (p. 561), and twice in *Larus dominicanus* (p. 570). It was this material which Fuhrmann studied when he described his new species *Hymenolepis chionis* and *Choanotaenia chionis* from *Chionis*; *Hymenolepis querquedulae* from the duck; and *Anomotaenia antarctica* and *Aploparaksis larina* from the gull. The correct name of the bird called *Chionis alba* in Fuhrmann's reports is *Chionis* (or *Chionarchus*) *minor* Hartl., since *C. alba* belongs to South Georgia (Werth 1931; Reichenow 1908).

by him as a misdetermination) is common to his southern list and Zschokke's list of Arctic species (1903). Szpotanska (1925), Baylis and Nybelin have added some species to this list—the first-named from Procellariiform birds, and the other two authors from rorquals—since the date of publication of Fuhrmann's report.

A few corrections relating to sea birds which range in the Southern Ocean or the Antarctic, and which are mentioned in Fuhrmann's excellent work on avian taenioid cestodes (1932) are now suggested :—

(1) The range of *Spheniscus magellanicus* is the coast of southern South America (Southern Chile to Southern Brazil), not South and South-west Africa (p. 187), which is the range of *S. demersus*.

(2) *Tetrabothrius joubini* was recorded from *Pygoscelis antarctica*, not from *P. adeliae*, unless it be admitted that Railliet and Henry's species is the same as *T. wrighti*.

(3) The light-mantled sooty albatross, *Phoebetria palpebrata*, is not listed as a host. It has apparently been included under the ordinary sooty albatross, *Phoebetria fusca* (syn. *P. fuliginosa*), since its parasite, *Tetrabothrius nelsoni* Leiper and Atk., collected by the "Terra Nova" in the Southern Ocean south-west of South-western Australia, is listed under *P. fuliginosa* (p. 190). It might be mentioned, however, that Reichenow, who studied the "Gauss" birds, grouped the two sooty albatrosses under the latter species. Szpotanska (1925, 726) has also listed *T. nelsoni* under *Ph. fuliginosa*.

(4) *Tetrabothrius diomedea* has been omitted from the list of parasites recorded from the yellow-nosed albatross, *Thalassogeron chlororhynchus*,—it was collected off Tristan da Cunha by the "Gauss" Expedition.

(5) *Tetrabothrius heteroclitus* has been omitted from those known from *Pagodroma nivea* (p. 189). It was recorded from the snow petrel by Railliet and Henry (1912, 38).

(6) "*Chionis alba* . . . South America" (p. 231), under which *Hymenolepis chionis* and *Paricterotaenia chionis* are listed, is an error for *Chionis minor* Hartl., the Kerguelen species, from which the "Gauss" material was obtained. Cestodes have not been reported from *C. alba*.

(7) As there is only one species of *Aptenodytes* in Antarctic waters, the other (*A. patachonica*) being typically subantarctic, *Aptenodytes* sp. should be incorporated with *A. fosteri* (p. 186).

(8) In view of my remarks in this report, *Diomedea* sp. (p. 188, 189) of the "Gauss" collection from which *Tetrabothrius pseudoporus* and *Chaetophallus umbrella* were recorded by Fuhrmann (1921), can be dropped, as the bird was *Phoebetria fuliginosa* from which these two cestodes are already listed. *Diomedea* sp. (p. 189) from Kamtchatka from which *Tetrabothrius heteroclitus* has been recorded, is most probably *D. brachyura* which ranges from Behring Strait and the Okhotsk Sea into the north tropical Pacific, though *D. nigripes* is a possible identification.

(9) Though not ranging in the region dealt with in this report, the list given under *Diomedea albatrus* (*syn. brachyura*) from the Northern Pacific (p. 188) may be commented on. Four cestodes are mentioned; *Tetrabothrius torulosus* and *T. heteroclita* are, of course, Linstow's records, based on Challenger material, the latter being his *Taenia diomedeae*. I have not been able to trace the authority for the presence of the two remaining cestodes (*T. pseudoporus* and *Chaetophallus robustus*) from this species of albatross. The former was recorded only from *Phoebetria fuliginosa* from the Southern Ocean (Kerguelen—*Diomedea* sp. of Fuhrmann 1921); while *C. robustus* was reported by Nybelin (1916) and by Fuhrmann (1921) as occurring in *Thalassogeron chlororhynchus* from the South Atlantic. Szpotanska (1925, 725) listed the same four species together with *Tetrabothrius wrighti* from *Diomedea albatrus*. The mention of the last-named parasite is an undoubted mistake, as the species is known only from Antarctic penguins. The rest of the list has obviously been derived from Professor Fuhrmann, in whose laboratory Szpotanska worked. Godman in his Monograph of the Petrels (1907–1910, p. 332) stated that the bird identified as *D. brachyura* in the Challenger Report is a different species, *D. nigripes*, so that it is under the latter name that *Tetrabothrius heteroclitus* and *T. torulosus* should now be listed.

(10) *Oestrelata arminjoniana* and *O. trinitatis* (p. 189) are now regarded as synonyms, this Trinidad petrel now being known as *Pterodroma arminjoniana*, and under it the three cestodes, *Tetrabothrius creani*, *T. aichesoni*, and *T. catherinae*, all described briefly by Leiper and Atkinson from the " Terra Nova " collection, may be placed.

Szpotanska (1925; 1929) in her accounts of the cestodes collected by the " Valdivia," gave neither localities nor dates, so that one is prevented from localising the collections definitely. The " Valdivia " reports are not available in South Australia, but Mr. W. A. Rainbow, Librarian of the Australian Museum, Sydney, has kindly supplied me with information regarding the places where certain birds were taken and with a sketch of the ship's track, and these assist in localising some of the cestodes. The birds concerned are :—

(1) *Catarractes* (i.e., *Eudyptes*) *chrysocome*, 3 January, 1899, St. Paul I., South Indian Ocean.

(2) *Diomedea exulans*, 19 October, 1898, off West African coast, 28° S., 3° E.; 2 November, 1898, from the South African coast.

(3) *Diomedea melanophrys*, several birds from the South African coast, 3 November, 1898.

(4) *Thalassogeron chlororhynchus*, 7 January, 1899, north-east of New Amsterdam Island.

(5) *Phoebetria fuliginosa*, 29 December, 1898, Bouvet I.; 5 December, 1898, 55° S., 22° E. (east of Bouvet).

(6) *Daption capense*, 11 October, 1898, Great Fish Bight (in Angola, about 17° S.); 25th November, 1898, Bouvet I.

(7) *Pagodroma nivea*, 29 November, 1898, south of Bouvet; 2 December, 1898, below 57° S., 13° E.

(8) *Priofinus cinereus*, 19 November, 1898, 45° S., 12° E.

(9) *Sterna virgata*, 28 December, 1898, Kerguelen.

(10) *Sterna macrura*, 2 December, 1898, 57° S., 13° E.; 22 December, 1898, 66° S.

(11) *Sterna melanauchen*, 20 February, 1899, Maldives.

(12) *Sula capensis*, 11 October, 1898, Great Fish Bight (W. Africa).

(13) *Sula cyanops*, 13 March, 1899, east of Zanzibar.

(14) *Sula piscator*, 17 January, 1899, Cocos Islands.

(15) *Fregata aquila*, 14 March, 1899, near Zanzibar; 17 January, 1899, Cocos Islands.

This list will allow us to give localities to the following cestodes described by Szpotanska (1925) from the "Valdivia" collection.

(1) *Tetrabothrius kowalewskii* from *Diomedea exulans* from 28° S., 3° E., and/or South African coast.

(2) *T. minutus;* (3) *T. magnus;* (4) *T. valdiviae* from *Procellaria* (= *Thalassoeca*) *antarctica*—all from the one bird presumably, since all were contained in the one jar.

(5) *Porotaenia siedleckii* (= *Chaetophallus setigerus*) from *Diomedea melanophrys*, South African coast; and from *Phoebetria fuliginosa* from the vicinity of Bouvet I.

(6) *Porotaenia brevis* (= *Tetrabothrius brevis*) from *Procellaria geliva* (*sic*) (i.e., *Proc. gelida* = *Priofinus cinereus*) 45° S., 12° E.; and from *Pagodroma nivea* in the vicinity of Bouvet I.

(7) *Porotaenia macrocirrosa* (= *Tetrabothrius macrocirrosus*) from *Thalassogeron chlororhyncha*, north-east from New Amsterdam I.

(8) *Porotaenia fragilis*, i.e., *P. fragilis* var. *exulans* Szp. 1917 (= *Tetrabothrius fragilis* var. *exulans*), from *Diomedea exulans* off South-west Africa or South Africa.

(9) *Porotaenia fragilis* var. *fuliginosa* (i.e., *Tetrab. fragilis* var. *fuliginosa*) from *Phoebetria fuliginosa* in the vicinity of Bouvet I.

(10) *Porotaenia fragilis* var. *capensis*, i.e., *P. fragilis* (typical) Szp. 1917 (= *Tetrab. fragilis*) from *Daption capense* either from South Africa (Algoa Bay) or from Bouvet.

(11) *Porotaenia longissima* (= *Chaetophallus longissimus*) from *Diomedea exulans* off either South-west or South Africa.

In this same paper she described three species collected by the "Gauss": *Chaetophallus musculosus* (= *C. umbrella*) from *Diomedea exulans* (? locality); *C. umbrella* from *Albatros* sp. (= *Phoebetria fuliginosa* from Kerguelen); and *Porotaenia fuhrmanni* (= *Chaetophallus fuhrmanni*) from *Priofinus* sp. (= *Priofinus cinereus*), locality ?

In her later paper (1929) Szpotanska described the following:—

(12) *Tetrabothrius sulae* and (13) *T. drygalskii* from *Sula* sp. (both from the same host bird).

(14) *Tetrabothrius hoyeri* from *Sula* sp. The hosts for these three species of cestodes must have been two of the three gannets mentioned, *Sula capensis* from Algoa Bay, *S. cyanops* from East Africa, or *S. piscatrix* from Cocos Island.

(15) *Tetrabothrius fregatae* from *Fregata aquila*, a species listed by Fuhrmann (1932, 28) as a synonym of *T. pelecani*. Locality, Indian Ocean.

(16) *Tetrabothrius eudyptidis* (recently transferred to *Neotetrabothrium* by Nybelin 1929, 510, 511) from *Catarrhactes* (i.e., *Eudyptes*) *chrysocome*, St. Paul I. in the South Indian Ocean.

(17) *Tetrabothrius cylindraceus* from *Sterna* sp. Apart from *Gygis candida* and *Anous tenuirostris* from the tropical Indian Ocean, three species of *Sterna* were taken; *S. virgata* from Kerguelen; *S. macrura*—the Arctic tern (= *S. paradisea*), which ranges from the Arctic to the Antarctic pack-ice, and was taken at 57° S. and at 66° S.; and *Sterna melanauchen* from the Maladive Archipelago.

As *T. cylindraceus* is a well-known parasite of North Atlantic terns and gulls, the host may have been the widely distributed Arctic tern, and if so, then *T. cylindraceus* would need to be added to the list of recorded Antarctic cestodes. *Sterna virgata* is restricted to Kerguelen and the Crozets.

Certain other species were described briefly and without hosts in Szpotanska's first paper (1917) to which the present author has not access. They are (18) *T. polaris*—syn. *T. intermedia*, var. *exulans* Szp. 1917; *T. kowalewskii* Szp. 1925; and *T. antarcticus* Fuhrmann 1921 (according to Fuhrmann 1932); and (19) *T. pseudoporus* (syn. *T. pseudoporum* Fuhrmann 1921). The host for *T. pseudoporus* is *Diomedea* sp.—"Gauss," i.e., *Phoebetria fuliginosa* from Kerguelen. Fuhrmann also stated (1932, 26) that *Porotaenia macrocirrosa* was a synonym of *P. kowalewskii* Szp. 1917 (= *Tetrabothrius kowalewskii*.) The host for *T. polaris* (syn. *T. antarcticus*) is *Diomedea exulans* from the South Atlantic in the region near Tristan da Cunha.

Szpotanska also referred to (20) *Tetrabothrius diomedea* var. *chlororhyncha* (1925, 683) which presumably is a synonym of *T. diomedeae*, as Fuhrmann (1921, 500) gave an account of this species from *Thalassogeron chlororhynchus*. She mentioned (21) *T. intermedia* var. *capensis* (1925, 682) which presumably may be regarded as a nomen

In this same paper she described three species collected by the "Gauss": *Chaetophallus musculosus* (= *C. umbrella*) from *Diomedea exulans* (? locality); *C. umbrella* from *Albatros* sp. (= *Phoebetria fuliginosa* from Kerguelen); and *Porotaenia fuhrmanni* (= *Chaetophallus fuhrmanni*) from *Priofinus* sp. (= *Priofinus cinereus*), locality ?

In her later p… …ska described the following:—

(12) *Tetrabothriu… …drygalskii* from *Sula* sp. (both from the same host bird).

(14) *Tetrabothriu… …p. The hosts for these three species of cestodes must have b… …e gannets mentioned, *Sula capensis* from Algoa Bay, *S. cyan… …a, or *S. piscatrix* from Cocos Island.

(15) *Tetrabothriu… …ata aquila*, a species listed by Fuhrmann (1932, 28) as a syn… …. Locality, Indian Ocean.

(16) *Tetrabothriu… …ly transferred to *Neotetrabothrium* by Nybelin 1929, 510, 5… …es* (i.e., *Eudyptes*) *chrysocome*, St. Paul I. in the South India…

(17) *Tetrabothriu… …i *Sterna* sp. Apart from *Gygis candida* and *Anous tenui… …pical Indian Ocean, three species of *Sterna* were taken; *S. vi… …n; *S. macrura*—the Arctic tern (= *S. paradisea*), which range… …the Antarctic pack-ice, and was taken at 57° S. and at 66° S… …nauchen* from the Maladive Archipelago.

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Szpotanska also referred to (20) *Tetrabothrius diomedea* var. *chlororhyncha* (1925, 683) which presumably is a synonym of *T. diomedeae*, as Fuhrmann (1921, 500) gave an account of this species from *Thalassogeron chlororhynchus*. She mentioned (21) *T. intermedia* var. *capensis* (1925, 682) which presumably may be regarded as a nomen

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nudum or as a synonym of *T. intermedia*; and also (22) *Chaetophallus robustus* var. *fuliginosa* (1925, 705) which may be regarded as a synonym of *C. setigera*, whose host is now known to be *Phoebetria fuliginosa*.

As the type of Szpotanska's genus *Porotaenia* belongs to *Chaetophallus*, the former falls as a synonym of the latter, and its species are accordingly distributed to *Chaetophallus* and *Tetrabothrius*, as indicated in an earlier paragraph (Johnston 1935).

The following species described by Szpotanska, or species of which they are synonyms, were collected by the "Valdivia" in the region of the Antarctic and Subantarctic, as defined above:—*Tetrabothrius minutus*, *T. magnus* and *T. valdiviae* from *Thalassoica antarctica; Chaetophallus setigerus* and *T. fragilis* var. *fuliginosa*, from *Phoebetria fuliginosa; T. brevis* from *Pagodroma nivea*. The following may perhaps also have been taken in the region:—*Tetrabothrius cylindraceus* from *Sterna* sp.; and *T. fragilis* from *Daption capense*.

Clausen (1915, 9, 47) stated that his material of *Tetrabothrius wrighti* and *Parorchites zederi* was collected by the "Valdivia" from *Aptenodytes forsteri* and entrusted to him by Professor Fuhrmann for study. The report on the "Valdivia" birds makes no mention of the taking of either the emperor penguin or the Adelie penguin, which are restricted to the ice zone. There is a reference to the collection of *Pygoscelis papua* from Kerguelen and *P. antarctica* from Bouvet, the most easterly locality known for the ringed penguin. Fuhrmann (1921) referred to both cestodes as having been collected by the "Gauss" in the Antarctic from *Aptenodytes forsteri*. It seems most probable that Clausen's material was the same as that examined by Fuhrmann and was obtained by the German Antarctic Expedition. I have accordingly not listed these two species of cestodes amongst those collected by the "Valdivia." There is a possibility that *T. wrighti* may have been taken by that vessel from *P. antarctica* which is a host for *T. joubini* of which *T. wrighti* is probably a synonym. Perhaps *Parorchites zederi* may have been collected from that bird too.

LIST OF CESTODES RECORDED FROM THE ANTARCTIC AND THE SUBANTARCTIC, ARRANGED UNDER THE EXPEDITIONS WHICH COLLECTED THEM.

The term Subantarctic is used here to include South Georgia, Bouvet, Crozets, Kerguelen, Macquarie Island and the region southward to the pack-ice. The term Antarctic would include the pack-ice belt and Antarctica. Graham's Land, South Shetlands and South Orkneys are partly antarctic and partly subantarctic.

The "Southern Cross" Expedition is not included separately as only one species of cestode was taken and no description was furnished to allow confirmation of what appears to be a wrong determination. Under the heading of "Other Collections" are included part of that of the "Challenger" and those made at South Georgia and South Shetlands by persons interested in sealing and whaling.

Taenia antarctica Fuhrmann 1921 is not included, since, though obtained from sledging dogs belonging to the "Gauss," it must have been brought from Asia along with its host.

I have excluded from the list given below those cestodes of oceanic birds taken north of the line referred to, hence the records from Tierra del Fuego, and some of those based on material collected by the "Gauss," "Terra Nova" and "Valdivia" (from some albatrosses and petrels) are not included. Six cestodes described by Szpotanska, for reasons mentioned at the end of the preceding section of this report, are included.

LIST OF CESTODES RECORDED FROM THE ANTARCTIC AND THE SUBANTARCTIC.

Name of Cestode.	Author and Date.	"Erebus" and "Terror" (Ross)	"Discovery" (Scott).	"Scotia" (Bruce).	"Pourquoi-pas" (Charcot).	"Terra Nova" (Scott).	"Gauss" (Drygalski).	"Aurora" (Mawson).	"Valdivia" (Chun).	Other Collections.
Glandicephalus antarcticus ...	Baird 1853	*	*	*	*	...	†	*	...	...
Diphyllobothrium quadratum	Linstow 1891	...	...	**	**	...	*	*	...	* (1)
D. tectum	Linstow 1891	...	...	...	...	...	†	*	...	* (1)
D. scotti	Shipley 1907	...	*	...	?	...	†	*	...	...
D. wilsoni	Shipley 1907	...	*	*	...	**	*	*	...	...
D. mobile	Rennie and Reid 1912 ...	...	...	*	**	**	*	*	...	...
D. scoticum	Rennie and Reid 1912 ...	...	...	*	...	...	†	*	...	...
D. perfoliatum	Railliet and Henry 1912 ...	...	...	...	*	*	*	*	...	...
D. lashleyi	Leiper and Atkinson 1914 ...	...	...	...	...	*	...	*	...	...
D. archeri	Leiper and Atkinson 1914 ...	...	...	...	...	*	...	...	...	...
D. rufum	Leiper and Atkinson 1914 ...	...	...	...	...	*	...	*	...	...
D. sp. (Pleroceroids from fish)	.....	...	...	...	...	*	...	*	...	...
Orygmatobothrium wyatti ...	Leiper and Atkinson 1914 ...	...	...	...	...	*	...	...	...	...
Phyllobothrium (larva) ...	.....	...	...	*	...	**	...	*	...	...

* Collected by the Expedition. † Described in the report of the Expedition but not collected by it.
** Collected by the Expedition but recorded under some other specific name. (1) From seals, South Georgia (Linstow.)

LIST OF CESTODES RECORDED FROM THE ANTARCTIC AND THE SUBANTARCTIC—*continued.*

Name of Cestode.	Author and Date.	"Erebus and Terror" (Ross).	"Discovery" (Scott).	"Scotia" (Bruce).	"Pourquoi-pas" (Charcot).	"Terra Nova" (Scott).	"Gauss" (Drygalski).	"Aurora" (Mawson).	"Valdivia" (Chun).	Other Collections.
Monorygma macquariae	Johnston 1937	...	...	...	...	...	...	*	...	...
Tetrabothrius wrighti	Leiper and Atkinson 1914	...	...	...	...	*	*	*	*	...
T. joubini	Railliet and Henry 1912	...	...	...	*	...	...	...	...	...
T. mawsoni	Johnston 1937	...	...	...	...	**	...	*	...	...
T. heteroclitus	Diesing 1850	...	...	...	*	...	...	*	...	** (2)
T. minutus	Szpotanska 1917	...	...	...	...	...	...	*	*	...
T. magnus	Szpotanska 1917	...	...	...	...	...	...	*	*	...
T. valdiviae	Szpotanska 1917	...	...	...	...	...	...	...	*	...
T. pseudoporus	Szpotanska 1917	...	...	...	...	...	*	...	...	...
T. affinis	Lonnberg 1891	...	...	...	...	...	...	...	...	* (4)
T. fragilis fuliginosa	Szpotanska 1917	...	...	...	...	...	...	...	*	...
Tetrabothrius sp. from petrels and skua.	.....	...	...	...	*	...	...	...	...	...
Tetrabothrius brevis	Szpotanska 1917	...	...	...	...	...	...	...	*	...
Chaetophallus fuhrmanni	Szpotanska 1917	...	...	...	...	...	*	...	...	...
Chaetophallus setigerus	Szpotanska 1917	...	...	...	...	...	...	...	*	...
Chaetophallus umbrella	Fuhrmann 1899	...	...	...	...	...	*	*	...	...
Neotetrabothrium eudyptidis	Lonnberg 1896	...	...	...	...	...	...	...	*	...
Priapocephalus grandis	Nybelin 1922	...	...	...	...	...	*	...	...	* (3)(4)
Parorchites zederi	Baird 1853	*	...	**	*	*	...	*	...	...
Paricterotaenia dominicana	Railliet and Henry 1912	...	...	...	*	...	...	†	...	(5)
Paricterotaenia chionis	Fuhrmann 1921	...	...	...	...	*	*	...	...	...
Anomotaenia antarctica	Fuhrmann 1921	...	...	...	...	...	*	†	...	(5)
Aploparaksis larina	Fuhrmann 1921	...	...	...	...	...	*	*	...	...
Hymenolepis chionis	Fuhrmann 1921	...	...	...	...	...	*	...	...	...
H. querquedula	Fuhrmann 1921	...	...	...	...	...	*	...	...	...

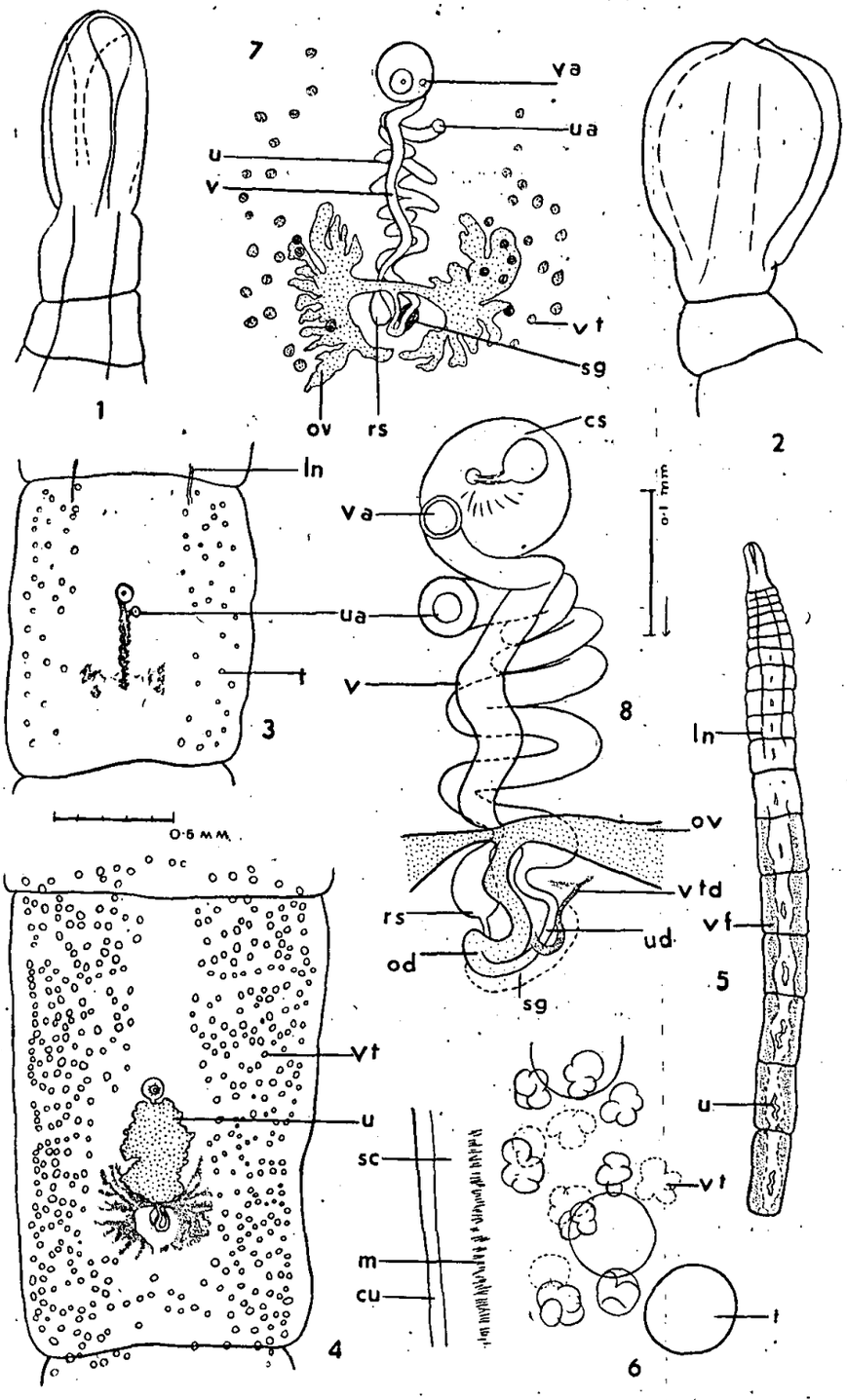
* Collected by the Expedition. † Described in the report of the Expedition but not collected by it.
** Collected by the Expedition but recorded under some other specific name. (2) From an albatross, Antarctic, "Challenger" (as *T. auriculatum* Linstow). (3) From whales, South Georgia (Nybelin 1922). (4) From whale, South Shetlands (Baylis 1926). (5) ? *Anomotaenia dominicana* with *A. antarctica* as probable synonym.

References to Lettering of Figures.

a, Atrium; as, anterior border of segment; c, cirrus sac; cb, cirrus bulb; cc, cavity of introverted cirrus; cm, circular muscle fibres; cs, cirrus sac; cu, cuticle; cw, cyst wall; dev, dorsal excretory vessel; e, egg; ej, mass of ejaculated sperms lying in vagina; ev, excretory vessel; fd, fertilising duct; ga, genital aperture; gp, genital papilla; lm, longitudinal muscle fibres; ln, longitudinal nerve; m, musculature; mf, muscle fibre; my, myoblast; n, nerve; oc, ovarian cavity; od, oviduct; ooc, oocapt; oocp, plug of tissue in oocapt; oot, ootyp; ov, ovary; r, rostellum; rmf, radiating muscle fibres; rs, receptaculum seminis; sc, subcuticula; sg, shell gland; sph, sphincter; su, secondary uterus; t, testis; tm, transverse muscle; u, uterus; ua, uterine aperture; ud, uterine duct; uw, uterine wall; v, vagina; va, vaginal aperture; vc, vaginal cavity; vd, vas deferens; vev, ventral excretory vessel; vf, vitelline field; vr, vitelline reservoir; vs, vesicula seminalis; vt, vitellarium; vtd, vitelline duct.

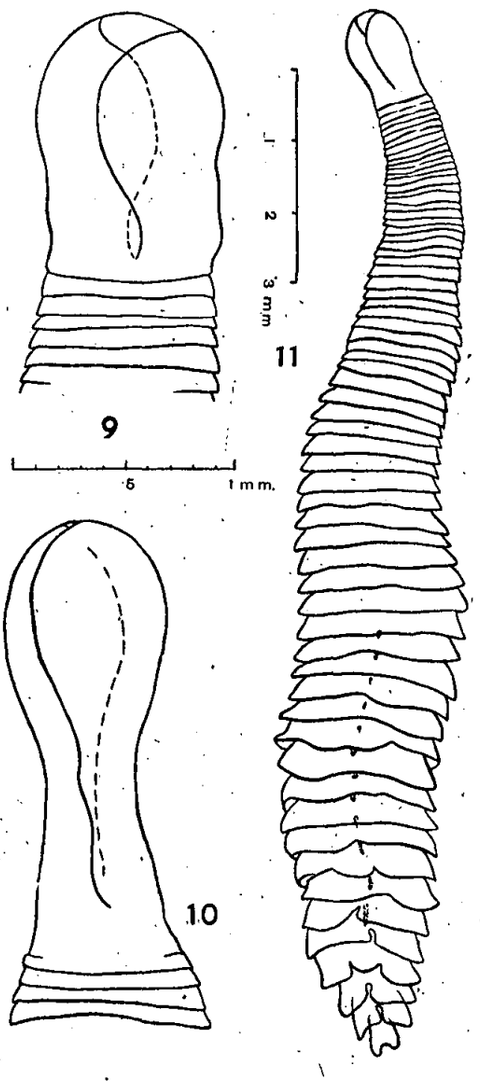
Additional note on Monorygma macquariae.

This report has been awaiting publication for many years and only a few minor alterations have been made since its acceptance. J. F. Hart, in his paper "Cestoda from fishes of Puget Sound, III, Phyllobothrioidea," (Tr. Amer. Micr. Soc., 55, (4), Oct. 1936, 488–496) described a new species, *Phyllobothrium magnum* (p. 489–492, figs. 1–4), from a shark, *Somniosus microcephalus* Bl. & Schn. The latter is the Greenland or sleeper-shark of the Arctic seas, while the host of the Macquarie Island parasite is probably the southern representative of the species or perhaps belongs to the same species. Hart's figures and short account suggest to me that *P. magnum* and M. *macquariae* are synonymous. The measurements given by him agree with those of the southern parasite. The only item of difference is that in the former the testes are stated to be relatively few in relation to the size of the segment. I regard *M. macquariae* as a synonym of Hart's species which is here assigned to *Monorygma* as *M. magnum* whose known range is now extended from the north-eastern Pacific to the Southern Ocean.



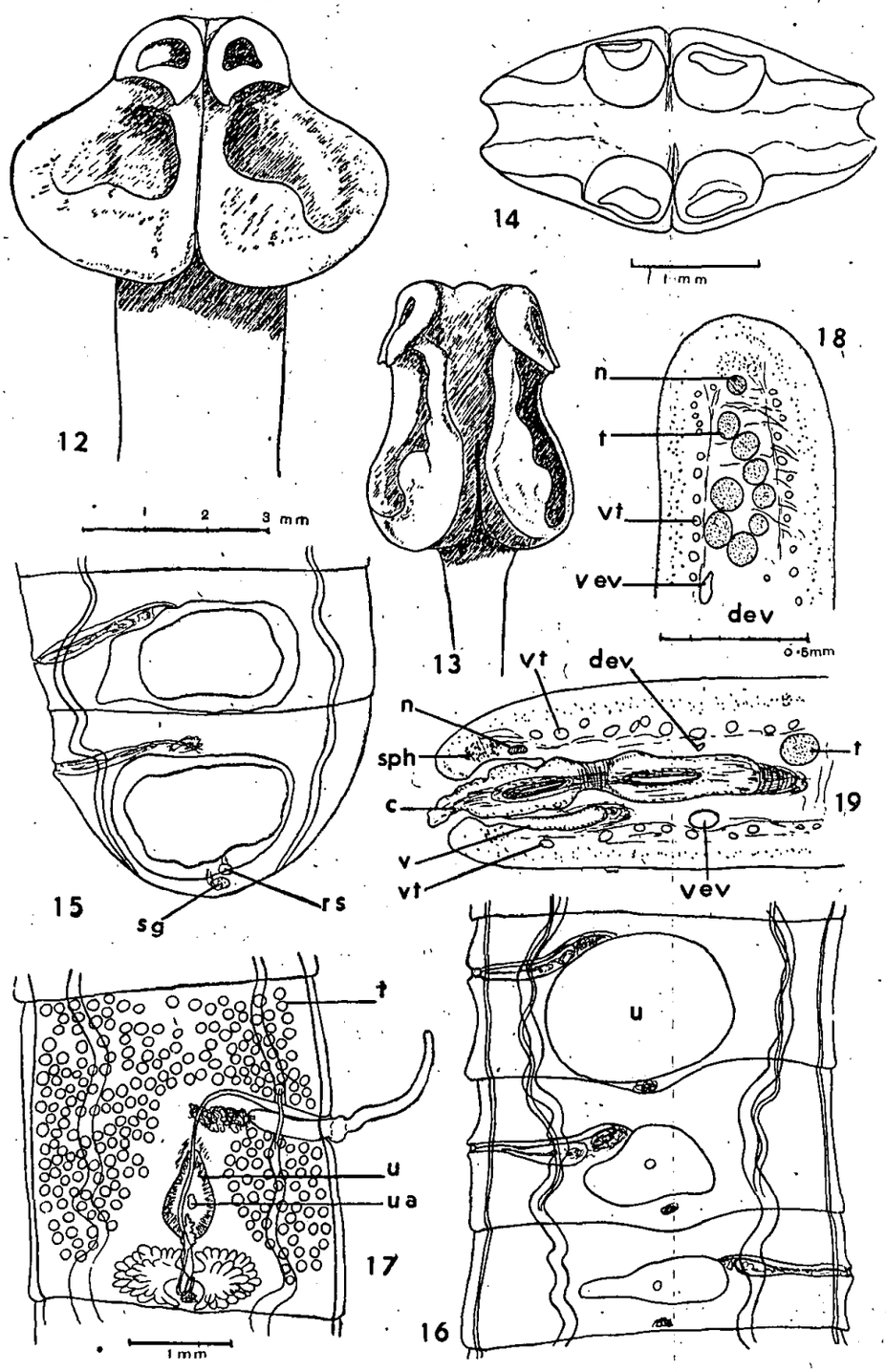
Figs. 1-8. *Diphyllobothrium lashleyi.*

1, Scolex, ventral. 2, Scolex, lateral. 3, Young segment showing early testes and developing ovary and uterus; vitellaria too small to be indicated at this magnification. 4, Mature segment showing vitelline arrangement, testes not indicated. 5, Entire strobila, vitelline fields dotted. 6. Portion of segment to show testes as well as dorsal (dotted) and ventral vitellaria. 7, Female genitalia, immediately before egg-bearing (ventral). 8. Female ducts at the stage when the first egg has entered the uterine duct (ventral). Figs. 1 to 4 drawn to scale below fig. 3; 6 and 8 to same scale (beside 8).



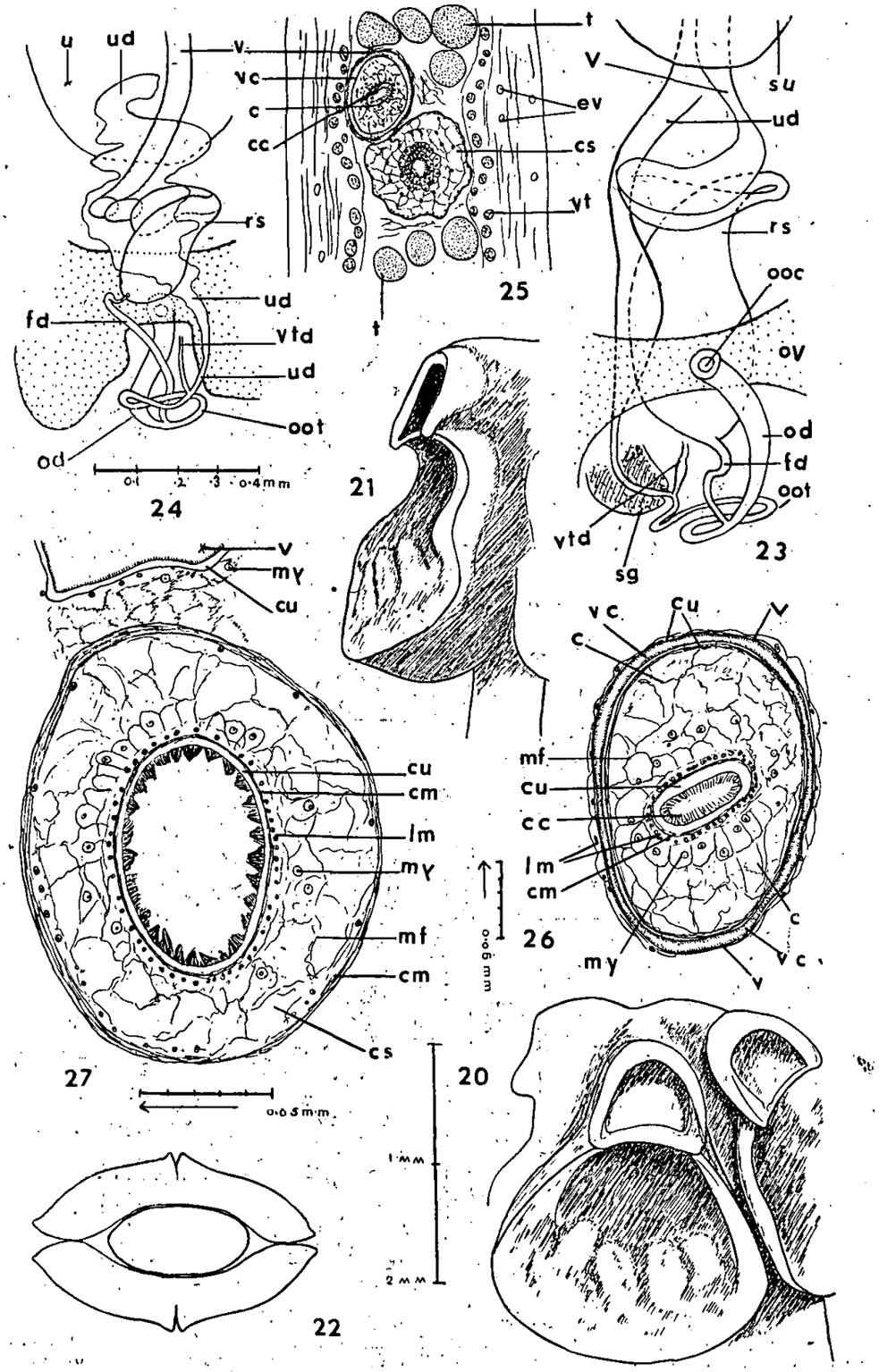
Figs. 9-11. *Diphyllobothrium rufum.*

9, 10, Scolices. 11, Strobila showing circumflex-like older segments and also rudiments of genital ducts. Nos. 9 and 10 drawn to scale (below 9).



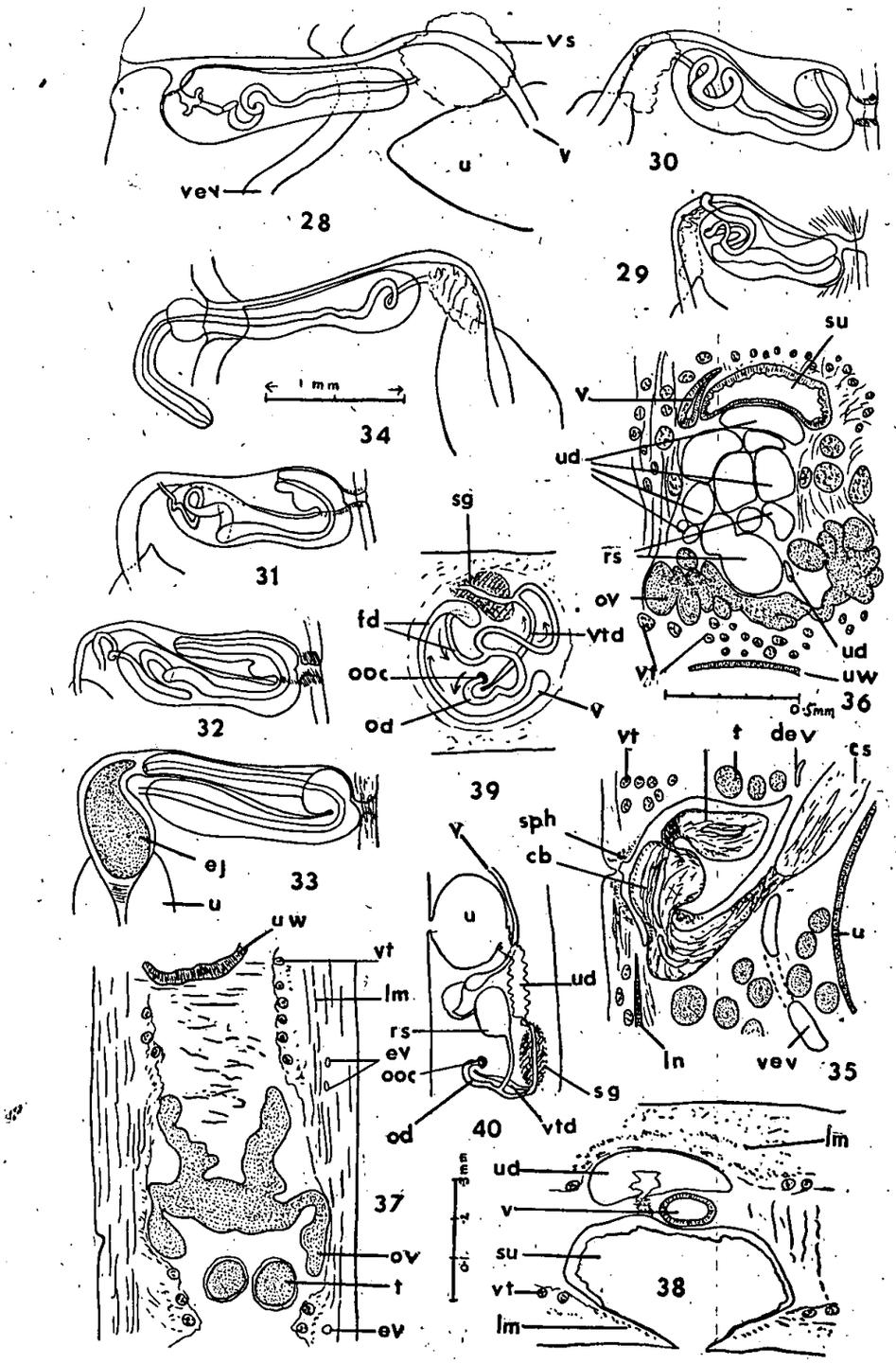
Figs. 12-19. *Monorygma macquariae.*

12, Scolex, surface view. 13, Ditto, side view. 14, Ditto, end view. 15, Ripe terminal segments with egg mass shrunken from uterine walls. 16, Part of ripe strobila; uterus of upper segment with eggs, that of middle segment almost empty, that of lower segment devoid of eggs. 17, Anatomy of segment, vitellaria not indicated. 18, T.S part of segment. 19, T.S. showing genital pore. Figs. 15 and 16 drawn to scale above 15; figs. 12, 13, 14 drawn to scale below 14; 18 and 19 to scale below 18.



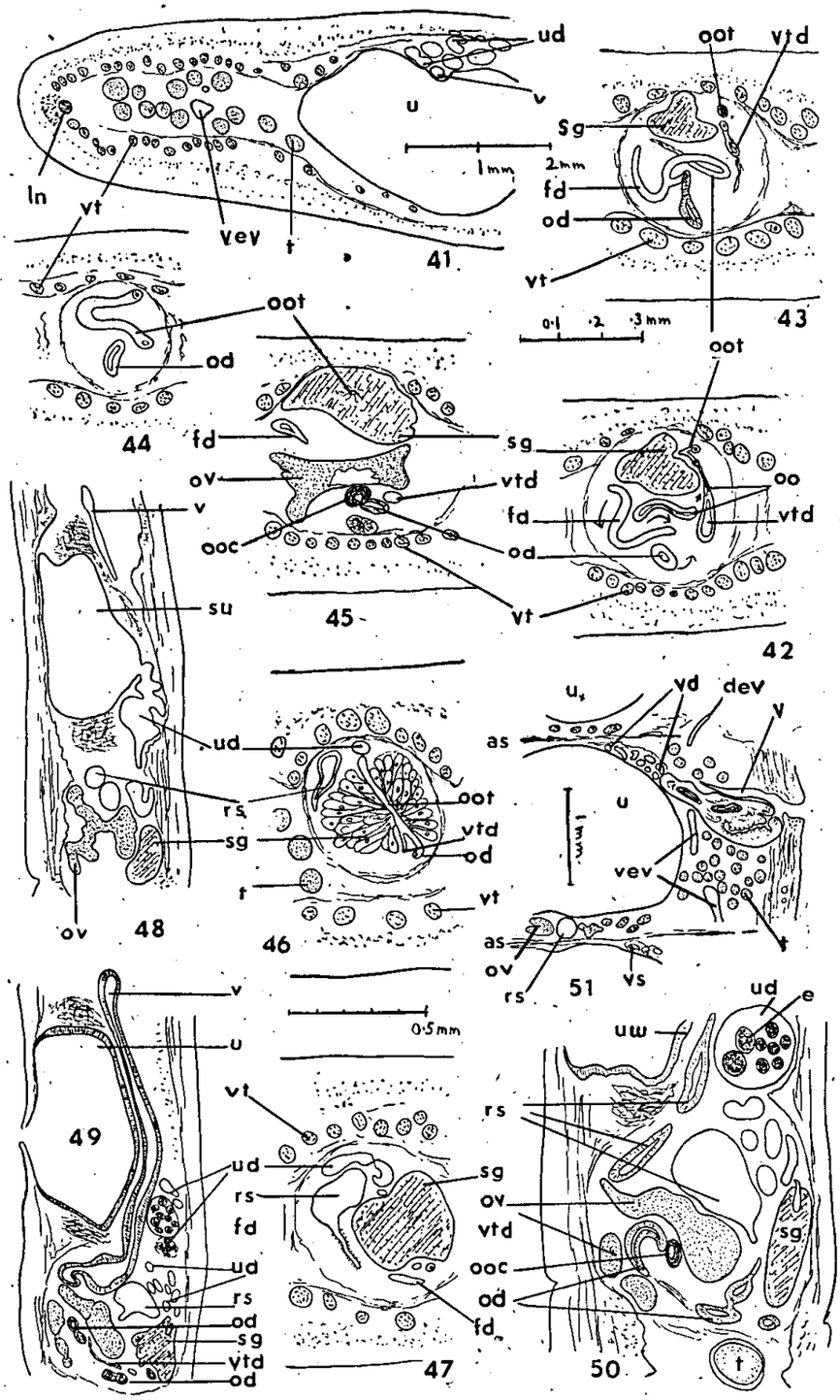
Figs. 20-27. *Monorygma macquariæ.*

20, Bothridium with accessory sucker. 21, Ditto, side view. 22, End view of scolex to show plan of bothridia. 23, Sketch of female ducts (ventral). 24, Female ducts (dorsal)—shell gland omitted. 25, Section of cirrus sac and of cirrus lying in the vagina and not fully everted. 26, Section of cirrus in vagina, part of cirrus still invaginated. 27, T.S. cirrus sac. Figs. 24 and 25 drawn to same scale (below 24); 20 and 21 to scale beside 20.



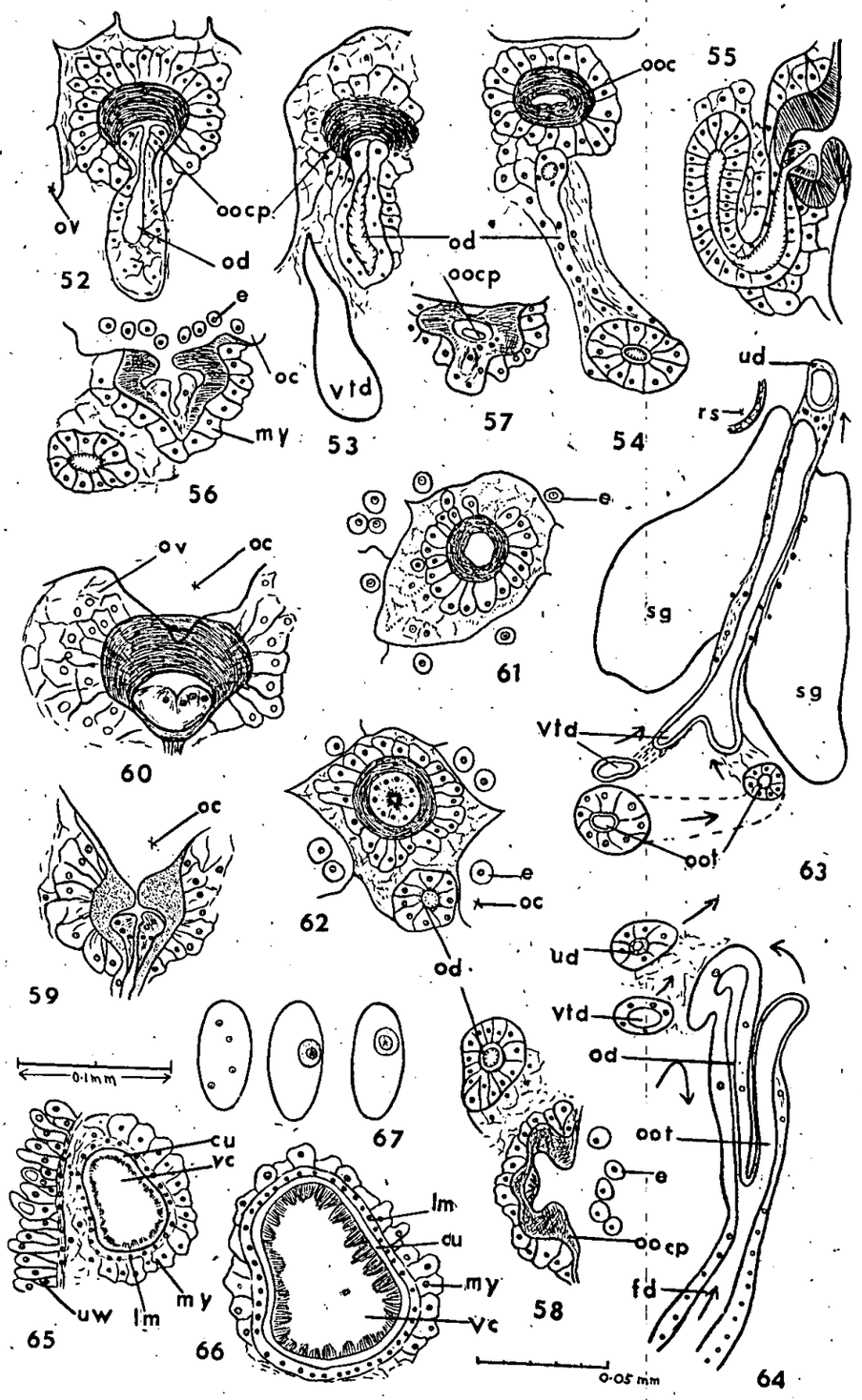
Figs. 28-40. *Monorygma macquariae.*

28–33, Various stages in self fertilisation. 34, Male duct and vagina. 35, Longitudinal section of cirrus entering vagina. 36, Longit. horiz. section showing relation of uterine duct to secondary uterus and ovary; vagina passing to one side of uterus. 37, L.V.S. segment at level of uterine pore; longitudinal muscles displaced by growing uterus, and practically absent on ventral surface below middle region of uterus. 39, Course of ducts in vicinity of shell gland—sketch based on several transverse sections. 40, Sketch of female ducts, based on L.V. sections. Figs. 28–34 drawn to scale below 34; 35 and 36 to that below 36; 37, 38, 39 to scale beside 38.



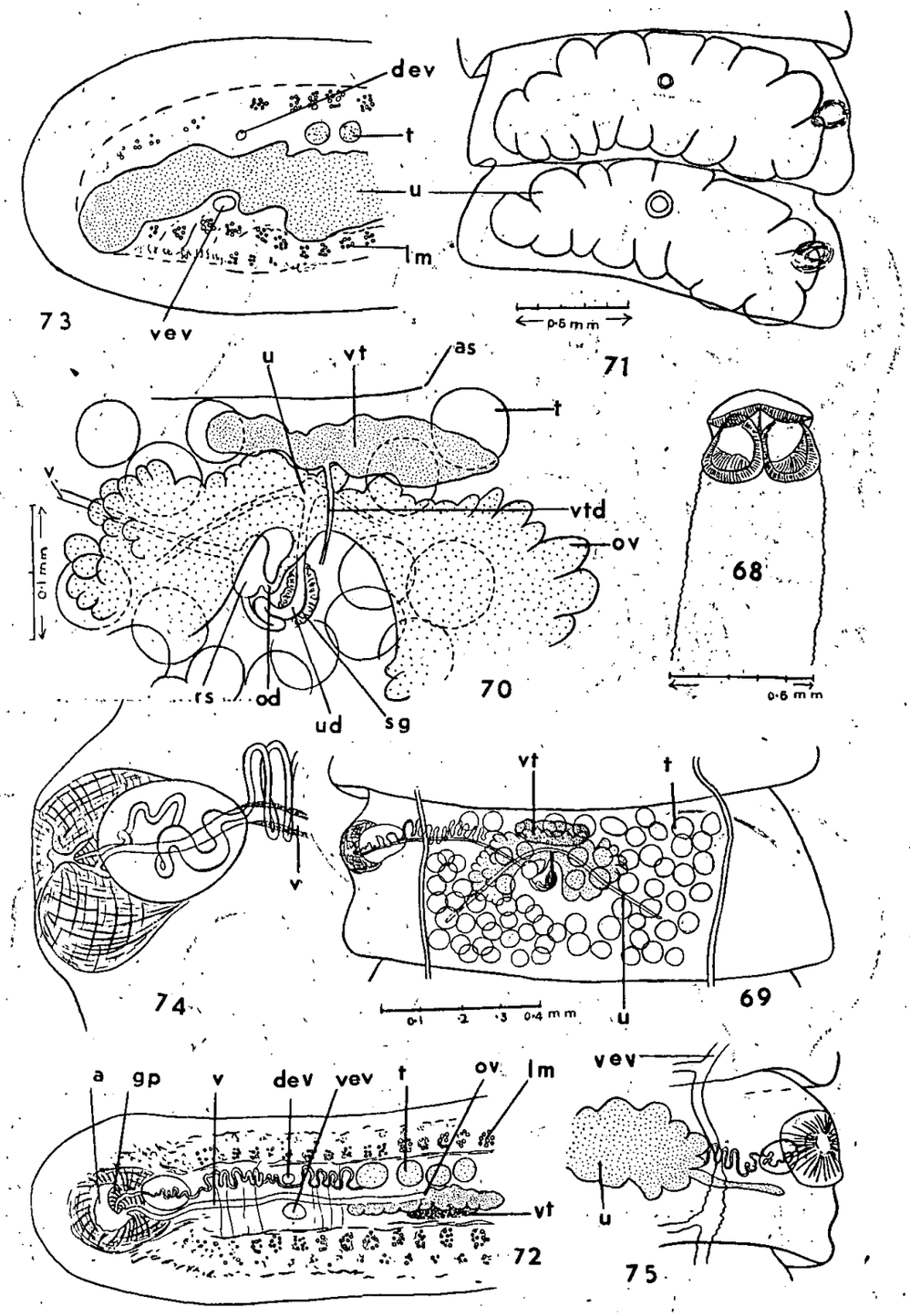
Figs. 41-51. *Monorygma macquariae.*

41, T.S. ripe segment. 42, Junction of vitelline duct and ootyp immediately before the latter enters shell gland. 43, Junction of oviduct and fertilising duct from receptaculum seminis—combined from three successive sections. 44, Section following No. 43. 45, Section of ovarian bridge, oocapt, and various ducts. 46, Junction of vitelline duct and ootyp; the latter passing dorsally through shell gland. 47, Relation of receptaculum, fertilising duct and other ducts. 48, L.S. segment showing relation of uterine duct to other organs. 49, L.S. through uterine pore and vagina. 50, Junction of vagina and oviduct. 51, L.H. section of genital pore; oblique section of end of cirrus becoming bulbous prior to entering vagina. Figs. 42, 43, 44, 45 and 50 drawn to same scale (below 43), but not necessarily from same series. Figs. 46–48 drawn to scale below 46.



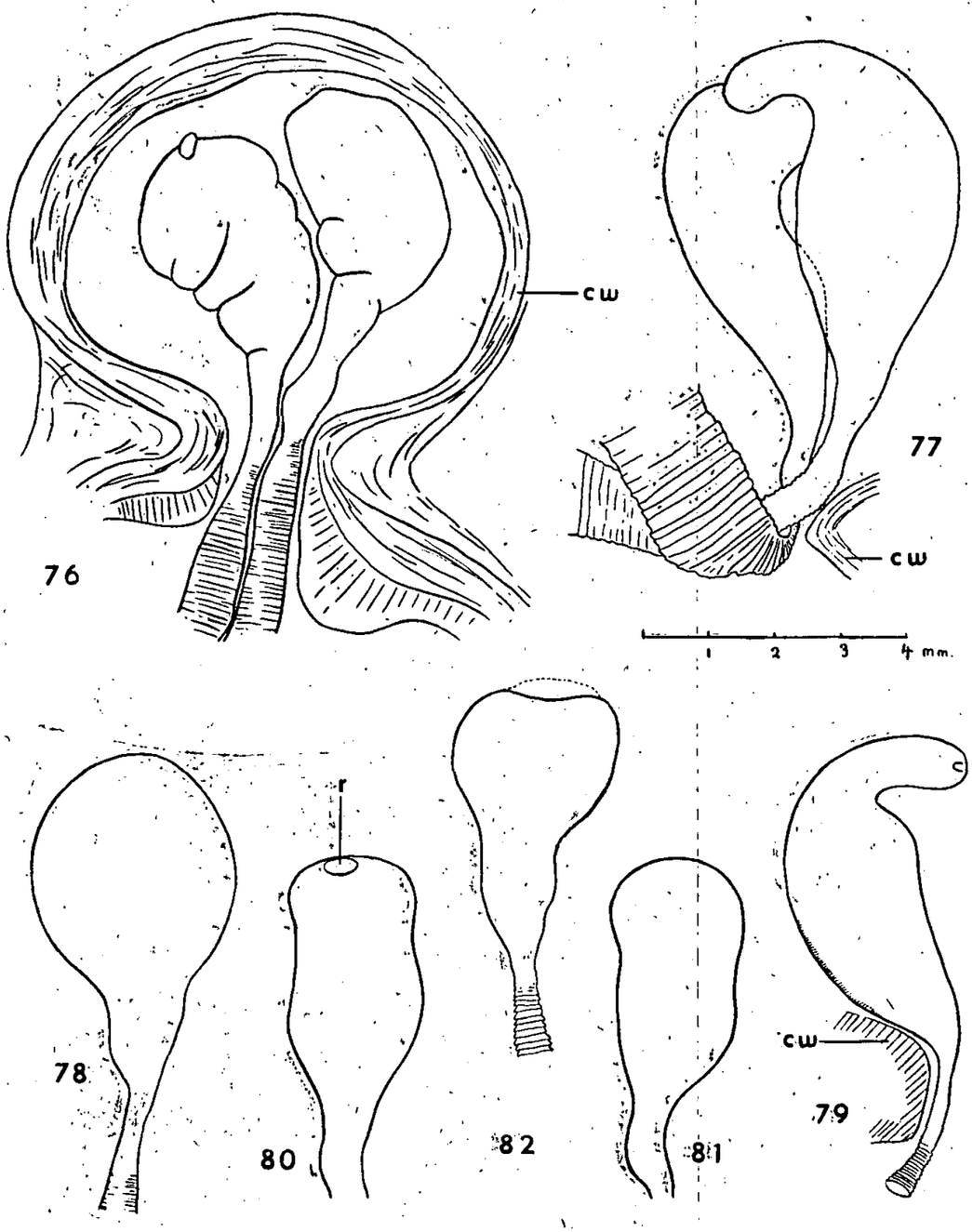
Figs. 52-67. *Monorygma macquariae.*

52–62, Various sections through oocapt and oviduct; ripe eggs in ovarian cavity in 56, 58, 61 and 62. 63, Junction of various ducts and their relation to shell gland. 64, Junction of oviduct with fertilising duct from receptaculum; vitelline duct converging towards ootyp. 65, T.S. middle of vagina, also shows structure of uterine wall. 66, T.S. vagina. 67, Eggs. Figs. 60-66 drawn to same magnification (scale below 58); remaining figures drawn to scale shown below fig. 59.



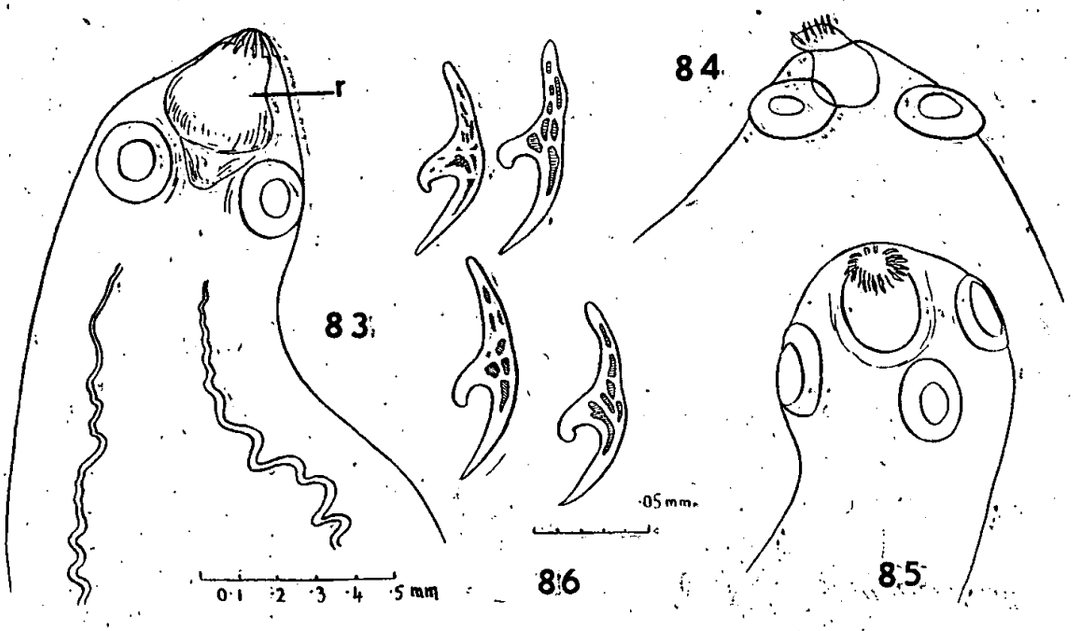
Figs. 68-75. — *Tetrabothrius mawsoni.*

68, Scolex (scale below). 69, Sexually mature segment. 70, Ovary in detail, also testes, yolk gland and earliest stage of uterus. 71, Ripe segment with uterine pores. 72. Optical transverse section of part of segment, atrium showing and ducts. 73, Optical transverse section of aporal margin showing uterine extension beyond excretory canals. 74, Atrium. 75, Margin of segment with atrium partly extruded. Figs. 70 and 74 drawn to scale beside fig. 70; figs. 69, 72, 73 and 75 drawn to scale shown below fig. 69.

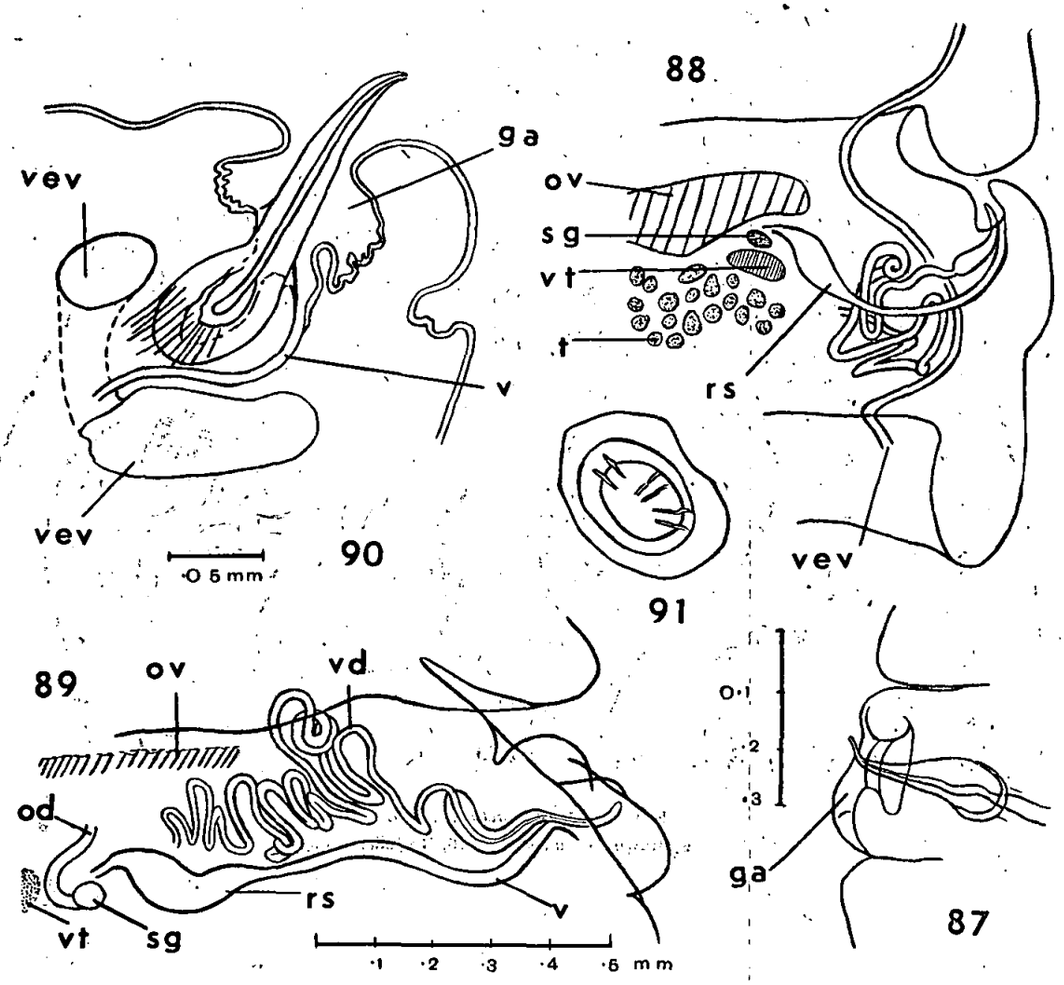


Figs. 76–82. *Parorchites zederi.*

76, Two cestodes in cyst; rostellum indicated in one. 77, Two others in cyst. 78, Anterior end of specimen removed from cyst. 79, Ditto. 80, 81, Ditto, two views of same parasite. 82, Ditto, extreme anterior end missing. All drawn to same scale.



Figs. 83-86. *Parorchites zederi.*
83–85 Scolices, drawn to same scale. 86, Rostellar hooks.



Figs. 87-91. *Parorchites zederi.*

87, Region of genital pore, cirrus protruding. 88, 89, Reproductive ducts. 90, Oblique section of part of segment, showing L.S. cirrus and atrium. 91, Egg. Figs. 87-89 drawn to same scale (beside 87).

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