

SOME AUSTRALIAN ECHIUROIDS (ECHIUROIDEA)

BY S. J. EDMONDS

Summary

Four new species of echiuroids, *Thalassema sydniense*, *Arhynchite hiscocki*, *Anelassorhynchus adalaidensis* and *Ochetostoma australiense* are described and six other species are listed from Australia. Some anatomical details of *Pseudobonellia biuterina* Johnston and Tiegs are redescribed and a key to the genera of Australian echiuroids is given.

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[Read 10 September 1959]

SUMMARY

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I. INTRODUCTION

The phylum Echiuroidea consists of a group of unsegmented, coelomate, marine invertebrates that is closely related to the Annelida and the Sipunculoidea. The phylum contains two chief families, the Echiuridae and the Bonellidae.

The present paper describes four new species and refers to the species previously recorded from Australia. Some anatomical details of one of the latter are re-described. The scheme of classification used is that adopted by Fisher (1946, 1948). The species are:

Family ECHIURIDAE

1. *Thalassema sydniense* n. sp.
2. *Arhynchite hiscocki* n. sp.
3. *Anelassorhynchus vegrandis* (Lampert).
4. *Anelassorhynchus porcellus* Fisher.
5. *Anelassorhynchus adelaidensis* n. sp.
6. *Ochetostoma australiense* n. sp.

Family BONELLIDAE

7. *Bonellia haswelli* Johnston and Tiegs.
8. *Pseudobonellia biuterina* Johnston and Tiegs.
9. *Archibonellia michaelsoni* Fischer.
10. *Archibonellia mjobergi* Fischer.

II. DESCRIPTION OF SPECIES

1. *Thalassema sydniense* n. sp.

pl. 1a, figs. 1-2

Thalassema Lamarck, 1801: Fisher, 1946, p. 230.

Specimens—4 (2 dissected): Aust. Museum specimens G11219.

Locality—Off Watson's Bay, Port Jackson, N.S.W.

Description—The four specimens are small and in the preserved state grey-brown in colour. The length of the trunk is 6-12 mm. and the maximum width 2-5 mm. The proboscis, still attached to the trunk in all specimens, is about half to a third as long as the trunk and gradually narrows anteriorly. The sur-

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face of the animal is covered with numerous, very small, rather flat papillae which appear to lie almost in transverse rows. They are more noticeable at the anterior and posterior regions of the trunk. The longitudinal musculature of the body wall is continuous.

Only a limited amount of information about the internal anatomy was obtained from the dissected specimens. The setae are comparatively large and prominent and strongly recurved at the tip. They are connected by a very prominent interbasal muscle. Another well-developed muscle runs from the base of each seta to a point on the body wall posterior to the nephridiopore of the first pair of nephridia. There are two pairs of nephridia all of which open to the exterior posteriorly to the point of extrusion of the setae. The lips of the nephrostomes are not elongated or spirally coiled and the internal opening is on a short peduncle near the base of the nephridia.

No satisfactory information can be given about the alimentary and vascular systems. The anal vesicles are about half as long as the trunk. No pre-cloacal, intestinal caecum appears to be present, but this point should be checked when more specimens are available for examination.

Systematic Position.

This species resembles *Thalassema steinbecki* Fisher, 1946, which is found along the Pacific coast of America from California to Ecuador. It differs, however, from *T. steinbecki* because the nephrostomes are on short expanded peduncles and for this reason it is considered to be a new species.

T. sydniense is known only from four specimens all of which are small. It differs from *A. porcellus* and *A. adelaidensis* in that:

- (1) the lips of its nephrostomes are not spirally coiled;
- (2) a strong interbasal muscle joins its setae;
- (3) the nephridiopores of the first pair of nephridia lie between the setae and the point of fixation on the body wall of a well-developed, posteriorly directed, setal muscle.

Type Locality—Off Watson's Bay, Port Jackson, N.S.W.

Type Specimen—Australian Museum, Sydney.

2. *Arhynchite hiscocki* n. sp.

pl. 1b, fig. 3

Arhynchite Sato, 1937, p. 142; Fisher, 1949, p. 485.

Specimen—1 (collected by Dr. I. Hiscock, University of Queensland).

Locality—"Dug from sand 18 in. down on the sandspit", Dunwich, Queensland.

Description—The specimen is long, slender and pencil-like. The length of the trunk is about 10 cm. and its width 4-6 mm. The specimen, preserved in alcohol, is yellow in colour. The body is covered with small, uniformly distributed papillae which are slightly larger at its anterior and posterior extremities. The papillae give the impression of being arranged in transverse rows. Anteriorly there is a very delicate and slender proboscis about 3 cm. long and 1-2 mm. wide. It is still attached to the trunk and its anterior extremity is flattened so as to make it fan-like. The longitudinal musculature is continuous and not grouped into bundles.

The specimen possesses one pair of nephridia about 1.5 cm. long that open to the exterior behind the setae. Each of the nephridia possesses a rather elaborate, leaf-like nephrostomal lip. The setae are long and are connected to strong, radiating muscles which arise from the body-wall. There is a well-developed interbasal muscle. The alimentary canal is very long and considerably coiled. The oesophagus is firmly fastened to the body by well-developed

mesenteries and the presiphonal segment is very long. No precloacal caecum is present on the intestine.

The vascular system consists of a prominent, tubular dorsal vessel that is closely associated with the alimentary canal for a considerable part of its length. It then appears to fuse with the intestine. The ventral vessel gives off a branch that joins the intestine at a point posterior to the point of fixation of the dorsal vessel. There does not appear to be a ring vessel. The system resembles rather closely that of a bonellid.

There are two very thin, slightly brown anal vesicles, the length of which is about one-quarter that of the trunk. On their surface there are numerous very small structures, presumably the ciliate funnels, that are visible only with the aid of a magnifier. The anal vesicles are fastened throughout their whole length by numerous fine muscles to the posterior region of the alimentary canal, but to the body wall only over the last quarter of their length.

Systematic Position.

This species differs from other species of the genus in (1) the structure of its vascular system, and (2) the way that the anal vesicles are attached principally to the alimentary canal and not to the body. The most closely related species is *A. arhynchite* (Ikeda) described from Japan.

The genus *Arhynchite* as defined by Sato (1937, p. 142) contained echiurids which did not possess a proboscis. Fisher (1949, p. 485), after finding two species that possessed a long deciduous proboscis, re-described the genus. The proboscis of the Australian species described in this paper was still attached to the specimen when it was collected.

A. hiscocki differs from other Australian echiurids in that:

- (1) its proboscis is very slender and flattened anteriorly; and
- (2) the lips of the nephrostomes are expanded into elaborate, leaf-like structures.

Type Locality—Dunwich (Stradbroke Is.), Queensland.

Type Specimen—Australian Museum, Sydney.

3. *Anelassorhynchus vegrandis* (Lampert)

Thalassema vegrande Lampert, 1883, p. 341.

Anelassorhynchus vegrandis Fisher, 1949, p. 481.

Australian Record—Low Is., Great Barrier Reef, Queensland (Monro, 1931).

Remarks—Monro gives no details of the anatomy of his specimens. *A. vegrandis* possesses three pairs of nephridia, all of which open to the exterior posteriorly to the setae. The lips of the nephrostomes are coiled.

4. *Anelassorhynchus porcellus* Fisher

pl. 1c

Anelassorhynchus porcellus Fisher, 1948, p. 274.

Specimens—12 (6 dissected). Collected by the author from under pieces of coral rock lying in loose coral sand near the level of low spring tides: 19/8/55.

Locality—Heron Is (Capricorn Group), Queensland.

Description—The animals are plump and sac-like and when alive sandy-grey in colour. The length of the trunk is 2.5-4.0 cm. and the maximum width 1.5-2.3 cm. The proboscis is 1.2-1.8 cm. long and readily deciduate; it tapers slightly anteriorly. The body wall is wrinkled and made verrucose by the presence of numerous flat papillae, which are largest on the anterior and posterior surfaces of the trunk. The skin appears to be thinner and smoother on the dorsal than the ventral surface. The musculature is continuous and not

grouped into bundles and two rather inconspicuous golden-coloured setae lie just posterior to the mouth. No interbasal muscle was found connecting them.

The alimentary canal is very long and frail. In all specimens it was filled with fragments of coral, small shells and coral sand which had ruptured the thin wall in many places. This prevented a thorough examination of the alimentary canal being made. The presiphonal section, however, is very long. The dorsal blood vessel is attached only to the anterior-most part of the foregut. There is a ring vessel, two dorso-ventral vessels which unite at a level just posterior to the setae and eventually connect with a rather poorly developed ventral vessel. There are two pairs of nephridia which open posteriorly to the setae. Their nephrostomes bear long, slender and slightly coiled prolongations which are often entangled in the coils of the intestine. The nephridia vary in size and in shape; in most specimens they are slender. There are two long, anal vesicles with numerous small unstalked funnels which appear to be in longitudinal rows. No caecum was found in the intestine.

Systematic Position.

I have not been able to find any character which can be used to distinguish these specimens from *A. porcellus*, Fisher described from Hawaii, where it has been found in sand under rocks in tide pools. The lips of the nephrostomes of the specimens from Queensland are less coiled and the ventral blood vessel appears to be not as well developed as those of *A. porcellus*. These differences may be caused by different methods of fixation.

A. porcellus possesses two pairs of nephridia which open behind the setae and which possess long spirally coiled lips. The presiphonal of the gut is very long.

Distribution—Hawaii; Heron Is., Queensland.

5. *Anelassorhynchus adelaidensis* n. sp.

pl. 2a

Anelassorhynchus Annandale, 1922, p. 148.

Specimens—8 (5 dissected).

Localities—St. Vincent Gulf, South Australia. Seven specimens were collected by the author from the sand and gravel amongst the roots of the marine angiosperm, *Cymodocea antarctica* at Aldinga Beach and one at Cape Jervis by Mrs. P. M. Thomas.

Description—This species is closely allied to *A. porcellus* Fisher, described from Hawaii and reported in the present paper, from Heron Is., Queensland. The South Australian specimens when alive are rich dark green in colour, while those from Queensland are sandy-grey. The length of the trunk of the specimens is 6-10 cm. and the maximum width 1.5-3.0 cm. The proboscis, a deciduous structure, is 2-4 cm. long and 0.5 cm. wide and tapers anteriorly. Its margin, though slightly wavy, is not frilled and its groove or trough is light green in colour. The skin of the animal is wrinkled and bears numerous small, flat, glandular papillae. The maximum length of the setae is 5 mm. and there is no interbasal muscle. The longitudinal musculature of the body-wall is continuous.

There are four nephridia which open behind the setae and which possess spirally coiled and elongate lips. The alimentary canal is long and tangled. Its presiphonal section is very long (as much as 8 cm. in one specimen) and thin-walled. There is no preloacal caecum.

The blood vascular system consists of a dorsal blood vessel, a ring vessel and two dorso-ventral vessels which join the ventral vessel. The latter is closely pressed to the ventral nerve cord. There are two long and slender anal vesicles which are attached to the body-wall only posteriorly. The vesicles are brown

in colour and their surface is covered with numerous, minute, brown funnels. The diameter of eggs found in the nephridia of one female was 0.13-0.17 mm. Whether they were ripe could not be ascertained.

Systematic Position.

These specimens resemble two specimens of a dark green echiurid collected at Amboina and described by Fischer (1896) as *Thalassema semoni*. *A. semoni* possesses four nephridia with spirally coiled lips. In one of Fischer's specimens all the nephridia open to the exterior behind the setae but in the other the first pair do not. Wharton (1913, p. 247) re-described the species from Buquet Is. (Philippines). According to him the first pair of nephridia open in front of and the second pair behind the setae. Since both pairs of nephridia of the South Australian specimens open behind the setae, it is most likely that they are a different species from *A. semoni*.

A. adelaidensis possesses two pairs of nephridia which open behind the setae and which have long, spirally coiled, nephrostomal lips. The presiphonal section of the gut is long. It is dark green in colour, differing in this respect from *A. porcellus* Fisher.

Type Locality—Aldinga Beach (near Adelaide), St. Vincent Gulf, S.A.

Type Specimen—Australian Museum, Sydney.

6. *Ochetostoma australiense* n. sp.

pl. 2b, fig. 4

Ochetostoma Leuckart and Ruppell, 1828; Fisher, 1946, p. 240.

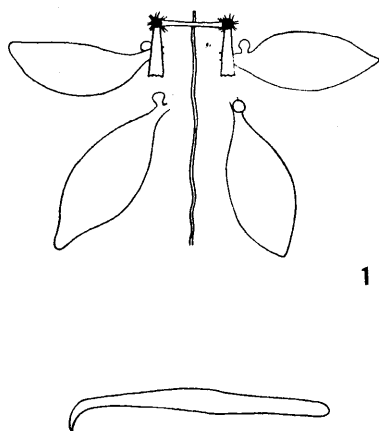
Specimens—21 (12 dissected).

Localities—Queensland: Stradbroke Is. (3 three specimens coll. S. Hynd), Myora (two specimens coll. I. Hiscock), Dunwich (eight specimens coll. I. Hiscock), Palm Is. (two specimens, from Univ. of Queensland). New South Wales: Goodwood Is., near mouth of Clarence River (six specimens coll. P. Durie), Aust. Museum specimens W3375, W3186, W3187.

Description—Mr. P. Durie says that the worms from Goodwood Is. are found "between high and low water marks in rather dark sand, situated close to some small mangrove clumps. The proboscis is white and fleshy and protrudes from a hole in the sand. It lies along the surface of the sand and is about 6 in. long and ½ in. wide. In this condition it appears to be quite flat (like a ribbon) and does not appear to take on a tube-like shape as in preserved specimens. The body of the worm is soft and bright red in colour. Twelve longitudinal muscle bundles show up very clearly."

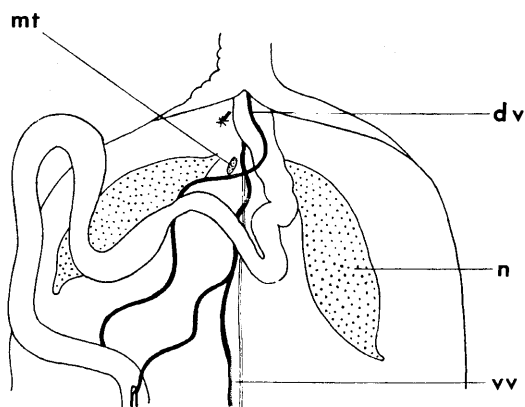
The length of the trunk of preserved specimens is 4.3-10.2 cm. and the maximum width 1.8-2.8 cm. The proboscis is 1.8-4.1 cm. long and not readily deciduate. Living specimens are red but preserved specimens are pale pink or straw coloured. The thickness of the skin varies. In some specimens it is thick, in others thin, the condition probably depending on the state of the musculature at fixation. There are usually 12-13, occasionally 11-14, longitudinal muscles which are best counted in dissected specimens. In all specimens except two there was one more band in the posterior half than the anterior half of the trunk. Of the 12 dissected specimens the maximum number of bands was 14 in one specimen, 13 in five, and 12 in six. The oblique musculature between the longitudinal bundles is grouped into numerous fascicles. The fascicles are not always noticeable in those parts of the body which have been stretched considerably. The anterior and posterior surfaces of the trunk bear small flat papillae.

There are three pairs of nephridia which vary in size and shape; generally they are long. One pair opens anteriorly to and the other two pairs posteriorly

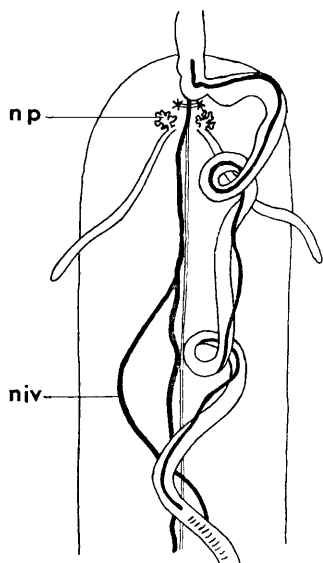


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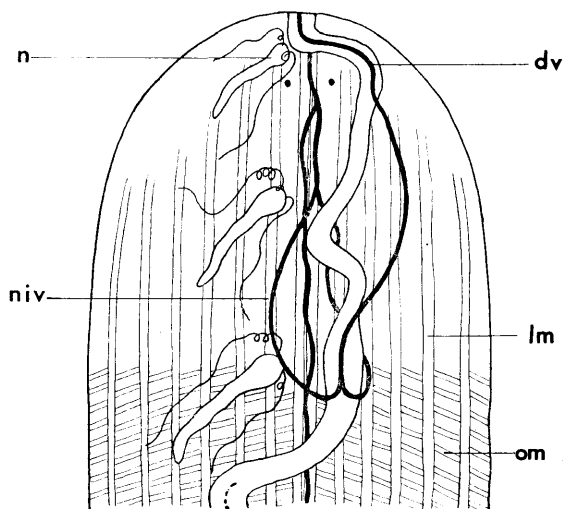
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Figs. 1-2.—*Thalassema sydniense*; 1, anterior region dissected to show nephridia, setae and setal muscles; 2, seta.

Fig. 3.—*Arhynchite hiscocki*; dissected specimen.

Fig. 4.—*Ochetostoma australiense*; dissected specimen showing anterior region of body.

Fig. 5.—*Pseudobonellia biuterina*; dissected specimen showing anterior region of body.

Legend.—dv = dorsal vessel, lm = longitudinal muscle, mt = male tube, n = nephridium, niv = neuro-intestinal vessel, np = nephridial process, om = oblique muscle, vv = ventral vessel.

to the setae. All the nephrostomes have long spirally coiled lips. No interbasal muscle was found between the setae. The alimentary system consists of a short anterior region, a long intestinal region possessing a ciliate groove and siphon and a short rectum. The anterior region is held in position by strong mesenteries attached to the body-wall and the other regions by numerous fine filaments. There is a precloacal, intestinal caecum.

The blood system is similar to that found in a number of species of *Ochetostoma*, e.g. *O. octomyotum* Fisher, 1946. There is a dorsal vessel, a ring vessel, two dorso-ventral vessels and a ventral vessel. The latter is placed close to the nerve cord and connects posteriorly with the precloacal caecum. There are two long anal vesicles with small unstalked ciliate funnels.

Systematic Position.

At least six species of *Ochetostoma* have been described that possess three pairs of nephridia, one pair of which opens in front of and two pairs behind the setae; *O. erythrogrammon* Leuckart and Ruppell, 1828, *O. stuhlmanni* (Fischer, 1892), *O. leptodermon* (Fischer, 1892), *O. caudex* (Lampert, 1883), *O. kokotoniense* (Fischer, 1892) and *O. griffini* (Wharton, 1913). Sato (1939, p. 357) considers the first five of these species to be synonymous.

The specimens from Australia are very close to *O. erythrogrammon* described from the Red Sea by Leuckart and Ruppell (1828). According to Fischer (1927, p. 112) the original description (which was not available to the present author) is "nur oberflächlich". Fischer (1927, p. 115) re-examined the species and described it as possessing 14-18 longitudinal muscle banners. This last point has been re-confirmed recently by Wesenberg-Lund (1957, p. 9) who re-examined a number of species of *O. erythrogrammon* from the Red Sea. She says, "There are 17 longitudinal muscles but at the level of the hooks the two dorsal-most bands on each side unite so that there are only 15 bands in the anterior part of the trunk".

There seems little doubt, therefore, that the species from the Red Sea possesses 14-18 bands, whereas that from eastern Australia possesses 11-14, usually 12-13. For this reason the latter is regarded as new and described as *O. australiense*.

O. australiense is a rather large species in which the longitudinal musculature of the body-wall is divided into 12-13, occasionally 11-14, bundles. It possesses three pairs of nephridia, the first pair of which opens in front of and the other two pairs behind the setae. Its anatomy resembles that of *O. erythrogrammon*.

Type Locality—Dunwich (Stradbroke Is.), Queensland.

Type Specimen—Australian Museum, Sydney.

7. *Bonellia haswelli* Johnston and Tiegs

Bonellia haswelli Johnston and Tiegs, 1920, p. 73.

Bonellia viridis Whitelegge, 1889.

Australian Record—Port Jackson, N.S.W. (Johnston and Tiegs, 1920).

Remarks—This species is known only from the account of Johnston and Tiegs (1920). The length of the trunk is over 2 in. and the maximum breadth $\frac{3}{4}$ in.; the length of the contracted proboscis 4 in. and of each of its arms $1\frac{1}{2}$ in. A siphon, about $\frac{1}{2}$ in. long, originates as a very narrow tube on the dorsal surface of the pharynx, widens posteriorly and ends blindly in a lobed structure. A single nephridium about $\frac{1}{2}$ in. long is situated on the left side of the body. The nephrostome is situated about a quarter of the length of the nephridium from its free end. The ovary is mid-ventral along the nerve cord. There are two

anal vesicles into which open about 15 tubes from which are given off smaller tubes with ciliate funnels. Coloured green when alive; the male is unknown.

This species possesses only one nephridium and consequently can be readily distinguished from *Pseudobonellia biuterina*, *Archibonellia michaelsoni* and *A. mjobergi* which possess 2-3 nephridia.

8. *Pseudobonellia biuterina* Johnston and Tiegs

pl. 2c, fig. 5

Pseudobonellia biuterina Johnston and Tiegs, 1919, p. 213; Fisher, 1946, p. 249.

Specimens and Localities—49 (12 dissected).

Queensland: North West Is. (5) (University of Queensland), Arkhurst and Hayman Is. (2) (coll. Dr. Mackerras), Whitsunday Passage (2) (Aust. Mus. Coll., W3029), Heron Is. (2) (coll. S. J. Edmonds).

Western Australia: Fremantle Harbour (21) (Mrs. L. Marsh), Dongarra (6) (coll. Prof. A. G. Nicholls), Pt. Peron (2) (coll. Prof. T. H. Johnston), Trigg Is. (8) (coll. M. J. Littlejohn).

Previous Australian Record—North West Islet, Masthead Is. (Capricorn Group), Queensland (Johnston and Tiegs, 1919).

Description and Discussion—The specimens from Queensland, although they differ in a few respects from Johnston and Tiegs's description of the species, are considered to be *P. biuterina*. Five specimens were collected at one of the type localities and two others at an adjacent island. They possess two nephridia (uteri) and carry a degenerate male in a small blind tube which opens to the exterior between the two nephridiopores. The male aperture shows up clearly just below the setae in all species.

The vascular system of the specimens is much more like that of a typical bonellid (Fisher, 1946, Fig. 15) than that described by Johnston and Tiegs. There is a dorsal vessel which makes contact with the alimentary canal at three points: anteriorly with the pharynx, then (usually) at a point on the oesophageal wall near the crop and finally at a point where it fuses with the intestinal wall just anterior to the origin of the siphon. A ventral or neural vessel runs along the nerve cord to the posterior region of the animal. Anteriorly, the ventral vessel gives off a neuro-intestinal vessel which makes contact with the intestine near the anterior extremity of the siphon. The neuro-intestinal vessel runs along the intestine and is closely associated with the siphon for about 1.5 cm. (Fig. 5).

The anal vesicles do not seem to communicate with the cloaca as simply as described by Johnston and Tiegs. The ciliate tubules arise in groups or fascicles from a slight outpocketing of the cloacal wall and show in some specimens some branching basally.

Johnston and Tiegs state that the ovaries "lie transversally on frenulae". The ovaries were inactive and invisible in the dissected specimens from North West Is., but in the specimens from Arkhurst and Hayman Is. developing ova, although small, lie clearly longitudinally along the posterior third of the ventral nerve cord. The transverse position of the ovaries, therefore, must be regarded with reserve until more specimens with gonads are available for study.

The vascular system and the anal vesicles of the Western Australian specimens are like those of the Queensland specimens. The ovaries of six specimens lie along the nerve cord. Eggs with a diameter of 0.25-0.3 mm. were found in the nephridia of the W.A. specimens. About 15 nematodes were obtained from the intestine of two specimens from Fremantle. They were found in the mid-gut and showed no sign of attrition or digestion. Whether they were

ingested along the sand and debris or whether they are intestinal parasites is not known.

Systematic Position.

P. biuterina is dark green in colour. It possesses two nephridia and a small blind tube which opens to the exterior between the nephridiopores. The male is carried in the tube. *P. biuterina* differs from *A. michaelsoni* Fischer, also described from Fremantle, W.A., in that its intestine is long and lacks a caecum and in the structure of the anal vesicles.

9. *Archibonellia michaelsoni* Fischer

Archibonellia michaelsoni Fischer, 1919, p. 83; 1921, p. 7.

Australian Record—Fremantle and Rottnest Is., Western Australia (Fischer, 1919).

Remarks—This species is described from a single specimen. The trunk of the specimen is about 12 mm. long and the proboscis terminates in two short lappets. The colour of the animal when alive is grey. The species possesses two very small nephridia and an unpaired "uterus". The intestine is short and bears a small caecum. The ovary lies along the posterior region of the nerve cord. The anal vesicles terminate in a bundle of tubules.

10. *Archibonellia mjobergi* Fischer

Archibonellia mjobergi Fischer, 1921, p. 6.

Australian Record—Broome, Western Australia (Fischer, 1921).

Remarks—This species is also described from a single "coal black" specimen. The trunk is 45 mm. long and the proboscis 18 mm. One arm of the proboscis is 50 mm. long and the other 10 mm. The species possesses one pair of large nephridia between which lies a very small unpaired nephridium.

III. KEY TO THE GENERA OF AUSTRALIAN ECHIUROIDS

1. Proboscis usually conspicuous (although sometimes deciduous if specimen is handled) and often several times the length of the body but never bifid. Anal vesicles long, sac-like, unbranched and covered with minute ciliate funnels — family *Echiuridae* 3, 4
2. Females with elongate, bifid proboscis. Anal vesicles with many branches that end in ciliate cups. Male degenerate, living in or on the female — family *Bonellidae* 9, 10
3. Longitudinal muscles of body-wall grouped into bundles. The interval between the bundles is crossed by numerous separate, small bundles of the inner oblique layer. 1-4 pairs of nephridia with spirally coiled, nephrostomal lips — genus *Ochetostoma*.
4. Longitudinal muscles of body-wall not grouped into bundles 5, 6
5. Nephrostomal lips either coiled or expanded into leaf-like structures 7, 8
6. Nephrostomal lips neither coiled nor expanded into leaf-like structures — genus *Thalassema*.
7. Nephrostomal lips long and spirally coiled — genus *Anelassorhynchus*.
8. Single pair of nephridia with nephrostomal lips produced to form leaf like structures. Proboscis long, deciduous and slender with a small fan like extremity — genus *Arhynchite*.

9. Only one nephridium or uterus present. Coelomic aperture of the nephridium is situated near the base of nephridium at the end of a short lateral tube — genus *Bonellia*.
10. More than one nephridium or uterus 11, 12
11. Two nephridia or uteri with nephrostomes placed near their distal ends. male permanently lodged in a small blind tube which opens between the nephridiopores — genus *Pseudobonellia*.
12. Third nephridium placed between two paired nephridia — genus *Archibonellia*.

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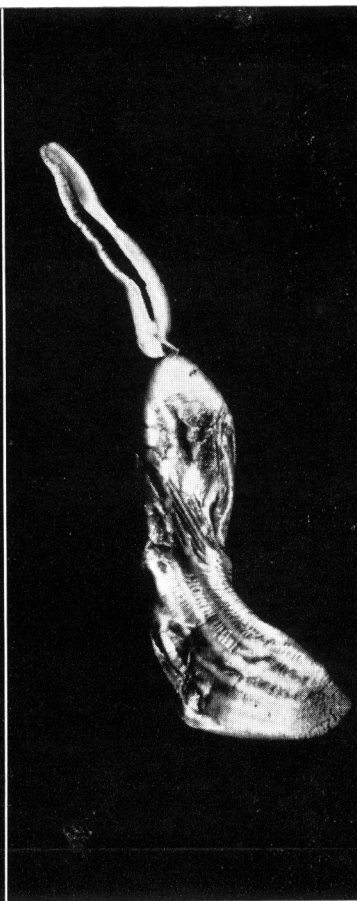
Thalassema
sydniense
1a.—This figure is
twice natural size.

Arhynchite
hiscocki
1b.—This figure is 8/10
natural size.

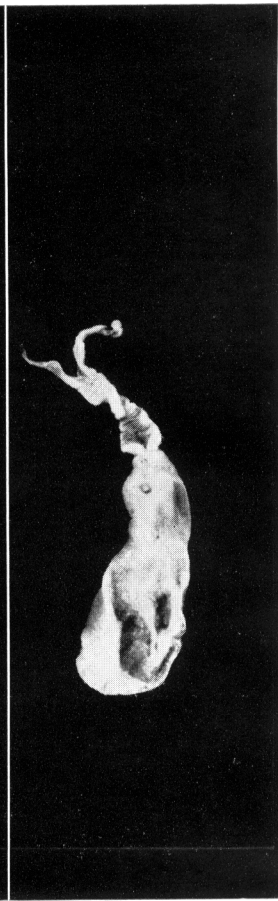
Anelassorhynchus
porcellus
1c.—Natural size.



Anelassorhynchus
adalaidensis
2a.—Natural size.



Ochetostoma
australiense
2b.— $2/3$ natural size.



Pseudobonellia
biuterina
2c.— $1.5 \times$ natural
size.