CHAPTER 1

INTRODUCTION

Until recently, little attention was given to the study of the parasite fauna of the black bream, *Acanthopagrus australis*, Günther 1859, especially the study of the taxonomy of its endoparasites. The ectoparasites of this species were studied by Roubal (1981) who produced what is considered to be 'the most complete description of the ectoparasite community on any Australian fish' (Roubal, Armitage and Rohde, 1983), and recently Byrnes (1985) conducted a comprehensive study on the ectoparasite fauna of all four Australian bream of the genus *Acanthopagrus*.

There are several studies concerned with endoparasites of fishes in Australia, e.g. Johnston (1914), Nicoll (1915), Baylis (1931, 1934, 1944, 1948), Hickman (1934), Woolcock (1935), Johnston (1934), Crowcroft (1944, 1947), Johnston and Mawson (1945a, 1945b), Johnston and Edmonds (1951), Mawson (1957), Manter (1966), Cannon (1977) and Kruse (1978, 1979a, 1979b); some of them are on black bream (e.g. Nicoll, 1915 and Johnston and Edmonds, 1951), but none of them is a comprehensive and intensive study.

The black bream is an important food fish in New South Wales and Queensland. It comprises about 6 percent of the total fish supplies in New South Wales (Roughley, 1951, 1963). The aim of this study is to investigate the endoparasite fauna of the black bream on the northern coast of New South Wales.

CHAPTER 2

BIOLOGY OF THE BLACK BREAM - A BRIEF REVIEW

2.1 The Australian Breams

According to the popular names, there should be some thirty species of bream in Australian waters (Thomson, 1974), but there are in fact only five or six (see e.g. Roughley, 1951 and 1963; Thomson, 1974). Three species are restricted to Australia, i.e. the black bream (silver bream, sea bream, surf bream, yellow-fin bream - *Acanthopagrus butcheri*) which ranges from Shark Bay in Western Australia to the eastern end of Bass Strait (see Figure 1) (Whitley, 1931 and Iredale, 1937, cit. Munro, 1949; Thomson, 1974); and the hump-headed bream (*Acanthopagrus palmaris*), which is restricted to a stretch of coast between Exmouth Gulf and Port Headland (also see Figure 1) (Munro 1949 and Thomson, 1974; according to Byrnes, 1985 a synonym of *Acanthopagrus berda*).

The remaining three species are not restricted to Australian waters, i.e. the Japanese bream (*Acanthopagrus latus*) known as yellow-fin bream in Western Australia, ranges across north Australia to the western side of the Gulf of Carpentaria, northwards to Japan and westwards to the Red Sea; the pickey bream (*Acanthopagrus berda*) ranges from the Burdekin River (see Figure 1) northwards around the Gulf of Carpentaria, overlaps the range of the Japanese bream as far as Darwin, then extends northward up to Japan, and westwards across the Indian Ocean as far as the Red Sea and the east coast of South Africa; it also extends eastward to New Caledonia and the Society Islands. The last species is the tarwine or silver bream (*Rhabdosargus sarba*) found all over Australia, the western Pacific and the Indian Ocean (see Munro, 1949 and Thomson, 1974).

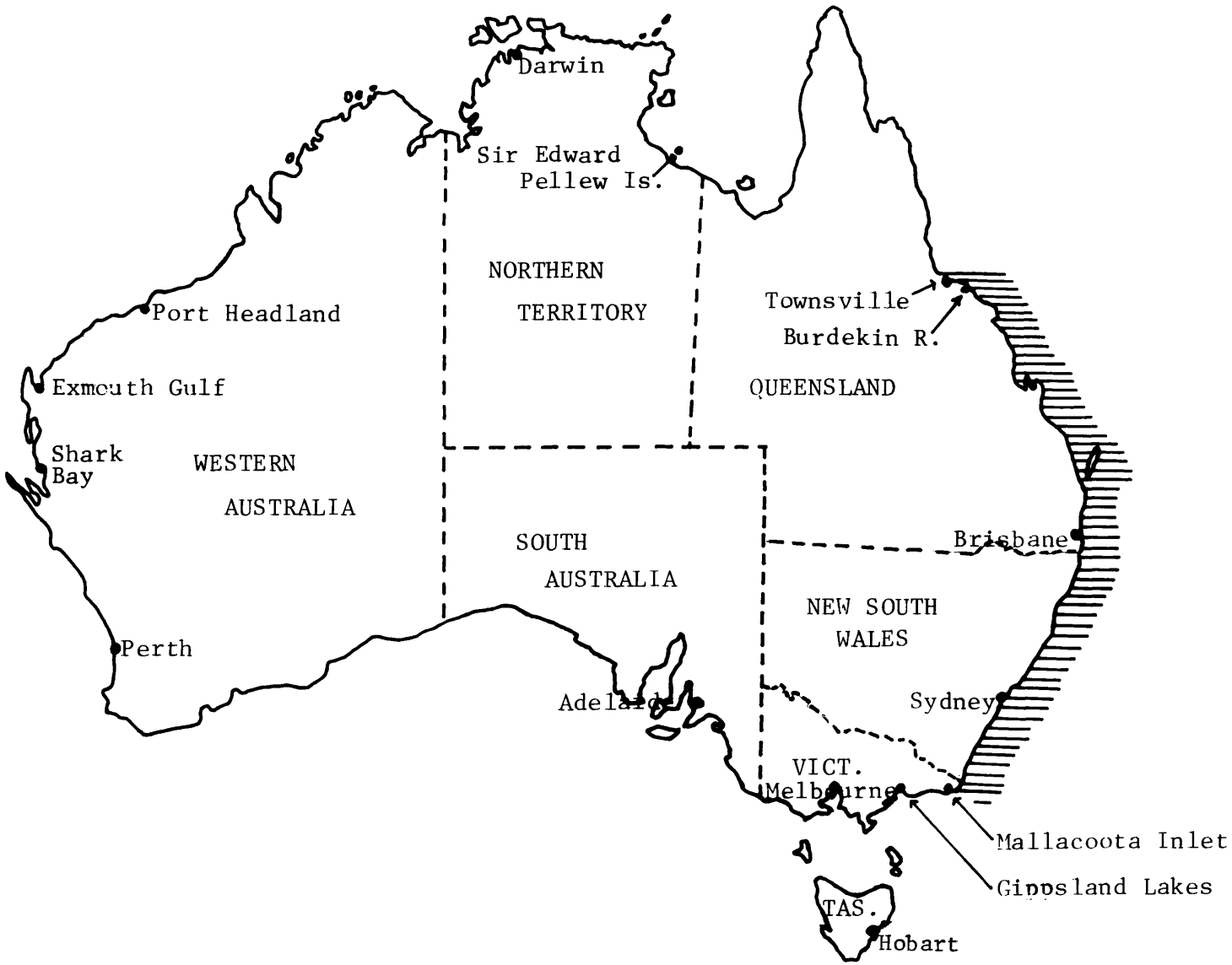


Figure 1. Distribution of Acanthopagrus australis
(after Munro, 1949)

2.2 The Black Bream - *Acanthopagrus australis* (Plate 1).

The black bream is also known as silver bream, sea bream, surf bream, and yellow-fin bream. Its scientific name is *Acanthopagrus australis*, synonyms *Chrysophrys australis* Günther 1959; *Sparus australis* Ogilby 1915; *Pagrus australis* Ogilby 1893; *Roughleyia australis* Whitley 1931; *Acanthopagrus australis* Smith 1938; *Mylio australis* (Günther, 1859) (see Whitley, 1931 and Munro, 1949).

Distribution

The black bream is endemic to Australia and confined to the east coast of Queensland, New South Wales and Victoria between latitude 19°S and 38°S, ranging from Townsville in north Queensland to the Mallacoota Inlet or to the Gippsland Lakes on the east coast of Victoria (Munro, 1949; Roughley, 1951, 1963).

Habitat

The black bream is essentially an estuarine fish. It can be found in coastal rivers, creeks, lakes, and brackish waters. It is mainly a bottom feeder (e.g. Munro, 1949; Roughley, 1951, 1963; and Thomson, 1974).

Growth

The black bream is a fish with a slow growth rate. According to Thomson (1974), the average length is 7.8 cm at one year old; 11.9 cm at two years old; 16.6 cm at three years old; and 24.4 cm at five years old. The largest black bream which was caught at Georges River, New South Wales, weighed 3.3 kg.

PLATE 1 : The Black bream, *Acanthopagrus australis* (Günther, 1859) (from Byrnes, 1985)

CHAPTER 3
MATERIALS AND METHODS

3.1 Collection of Hosts (see Figures 2 and 3).

Samples of the black bream were collected from 8 different localities on the northern coast of New South Wales between June 1980 and March 1985 as follows:

(1) by handline at Arrawarra Headland ($153^{o}12'E$, $30^{o}04'S$), 26 specimens, caught by F. Roubal;

(2) by handline at Arrawarra Lagoon ($153^{o}12'E$, $30^{o}04'S$), 12 specimens, caught by F. Roubal;

(3) by gill-net at Woolooweyah Estuary ($153^{o}22'E$, $19^{o}26's$ - near the mouth of Clarence River), 22 specimens, caught by F. Roubal;

(4) by handline at Yamba (the mouth of Clarence River, $153^{o}22'E$, $29^{o}26'S$), 9 specimens, caught by F. Roubal;

(5) by handline at MaClean (upstream from the mouth of Clarence River, $153^{o}12'E$, $29^{o}28'S$), 1 specimen, caught by F. Roubal;

(6) by handline at Urunga (the mouth of Kalang River, $153^{o}01'E$, $30^{o}30'S$), 8 specimens, caught by F. Roubal;

(7) by handline at Red Rock National Park ($153^{o}13'E$, $29^{o}56'S$), 16 specimens, caught by F. Roubal;

(8) by handline at Red Rock Estuary ($153^{o}13'E$, $29^{o}59'S$), 351 specimens, caught by F. Roubal and A.S. Bahrudin;

(9) 4 specimens from an unknown New South Wales locality had been kept in aquaria at the Zoology Department, University of New England, Armidale, for some time.

Parasites were collected from fish preserved in 10% formalin and from fresh fish dissected immediately after capture at the O'Farrell

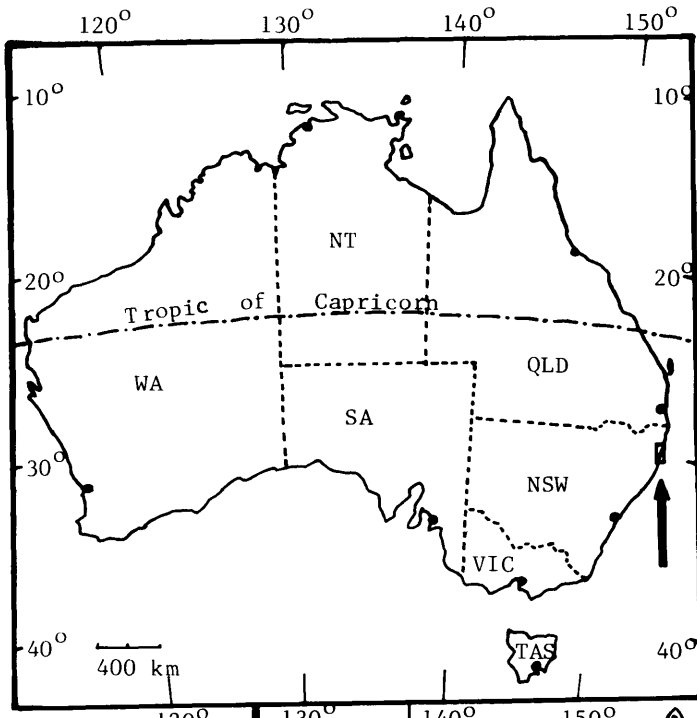


Figure 2. Study Area

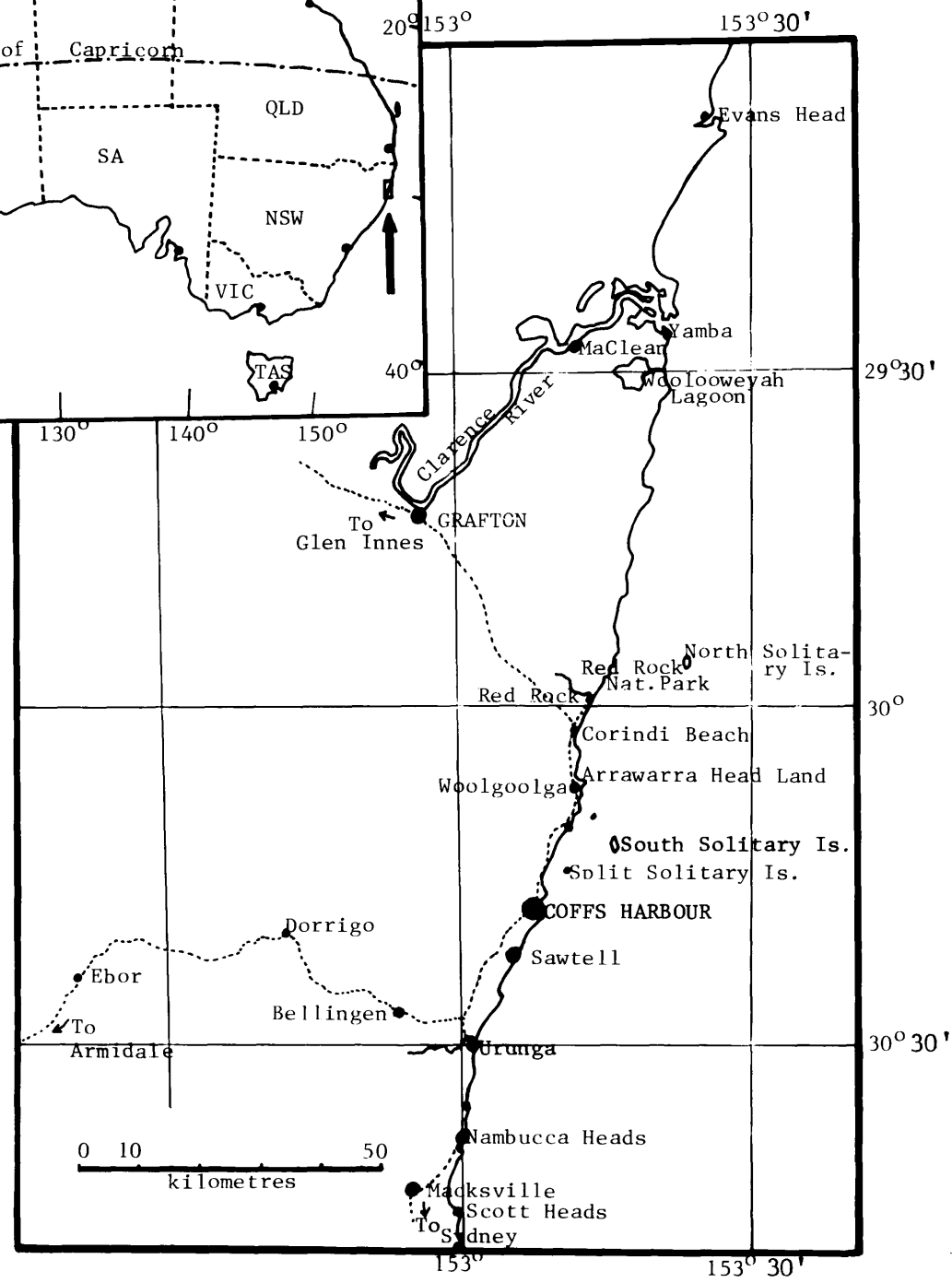


Figure 3. Study Area (in detail)

Marine Field Station of the Department of Zoology, University of New England, at Arrawarra.

Immediately after capture, fish to be preserved in formalin were killed by severing the spinal cord, their belly and gut were cut open and they were then dropped into 10% formalin. The head length, the total length, the weight and the length to caudal fork of all preserved and fresh fish were recorded. The gut from each fish was separately preserved in 10% formalin for further examination.

3.2 Examination of Parasites.

Examinations were made both of preserved and fresh material.

Fresh material was examined in two ways, i.e. (1) the fish were transported in sea water to the laboratory at Arrawarra Headland, the gut was cut open and put into 0.7% saline solution, then examined under a binocular dissecting microscope. The endoparasites found were placed on a slide in 0.7% saline solution, covered with a cover glass, and examined under a light microscope. Sometimes rough drawings were made of the parasites. (2) The fish were killed immediately, the guts were cut open, placed in a 0.7% saline solution and examined at the laboratory not later than two hours after capture.

Each of the viscera was divided into ten parts, namely: the oesophagus, the stomach, the pyloric caeca, the anterior intestine, the posterior intestine, the rectum, the gall-bladder, the liver, the mesenteries, and the spleen. The debris (sediment) was also examined.

The endoparasites collected alive, after microscopical study, were killed in 10% boiling formalin in order to provide consistently shaped specimens. They were transferred to 70% alcohol after several hours.

Selected specimens of digenetic trematodes collected from fresh and preserved fish were stained, where possible, in three different

ways, i.e. by Chubb's method (Chubb, 1962); Grenacher's Alum Carmine (see e.g. Cowdry, 1943, Davenport, 1960); and Ehrlich's Hematoxylin (Bensley and Bensley; 1938, Pantin, 1946, Humason, 1962 and Knudsen, 1972). Permanent mounts in Canada balsam were made of the Digenea. When necessary, identification of Digenea was also based on serial sections. Sections of Digenea, mainly from fish preserved in formalin, were made by Mr W. Higgins of the Department of Zoology, University of New England.

Nematoda, Acanthocephala and Cestoda were placed in glycerol for about 20 minutes, then transferred to lactophenol creosote until clear. For specimens with a very thick body wall, methyl benzoate was used for clearing. Temporary mounts in lactophenol creosote were made of nematodes, acanthocephalans and cestodes. Cestodes were also stained; however the results showed that simple clearing was better than staining. Acanthocephala were not stained.

3.3 Measurement and Drawings.

Specimens of digenetic trematodes, cestodes, nematodes and acanthocephalans were measured with a calibrated ocular micrometer. Throughout this thesis, measurements are given in micrometres, as means, with ranges in parentheses, if not otherwise stated.

All drawings were made with the aid of a camera lucida.

3.4 Identification.

The endoparasites were identified to genus level using the monographs of Yamaguti (1958, 1959, 1961, 1963, 1970, 1971a, 1971b); the CIH Keys to the nematode parasites of the vertebrates No. 1, No. 2, No. 3 and No. 6 respectively of Anderson, Chabaud and Willmott (1974), Hartwich (1974), Chabaud (1975) and Chabaud (1978); Yorke and Maplestone (1926); Dawes (1946); Hyman (1951a, 1951b); Barnes (1968);

Baer (1971); Meglitsch (1972); Cheng (1973); Chitwood and Chitwood (1974); Olsen (1974); and Noble and Noble (1976). Relevant papers were used for species diagnosis. Checklists of parasites, e.g. Young (1939); Hewitt and Hine, (1972); Beumer *et al.* (1982) and the Helminthological Abstracts were also used.

3.5 Statistical Analysis.

Since the majority of fish samples came from Red Rock Estuary, evaluation of seasonal fluctuation in intensity and prevalence of infection is restricted to that area.

For the statistical analysis Bishop (1966), Zar (1974) and Parker (1979) and some relevant papers (e.g. Meskal, 1967 and Moravec, 1982) were used. For statistical analysis of allometric growth, Sholl (1948); Jolicoeur (1963); Rohde (1966); Fischthal (1978a, 1978b); Fischthal, Fish and Vaught (1980); and Fischthal, Carson and Vaught (1982) were used.

The data were analysed by means of the SPSS package on a DEC-20 computer.

Mr R.P. Hobbs assisted me in dealing with the statistical analysis.

Specimens are deposited in the Australian Museum.

CHAPTER 4

RESULTS

4.1 General Results

Of 449 fish, only 296 specimens (65.9%) were invaded by helminths (Table 4.1).

Table 4.1 Locality, number of fish examined and invaded

Locality	No. of fish examined	No. of fish invaded	% of local fish invaded	% of total fish invaded
Arrawarra Headland	26 (5.8%)	7	26.9	1.6
Arrawarra Lagoon	12 (2.7%)	5	41.7	1.1
Woolooweyah Estuary	22 (4.9%)	4	18.2	0.9
Yamba	9 (2.0%)	5	55.6	1.1
MaClean	1 (0.2%)	1	100.0	0.2
Urunga	8 (1.8%)	1	12.5	0.2
Red Rock National Park	16 (3.6%)	9	56.3	2.0
Red Rock Estuary	351 (78.2%)	264	75.3	58.8
Zoology aquaria, UNE	4 (0.9%)	0	-	-

The majority of fish in this study was from one locality, that is Red Rock Estuary (351 specimens or 78.2% of total fish samples). Most parasites were from this locality as well.

The endoparasites found in this study belong to 4 groups, i.e. digenetic trematodes, cestodes, nematodes and acanthocephalans. However, some larval forms could not be identified, due to bad fixation.

4.2 The Nature and Number of Parasites

The total load of parasites was 3911 specimens, composed as follows:

A. Digenetic trematodes, 3597 specimens or 92.0% of total parasites. They were comprised of:

(a) *Coitocaecum gymnophallum* Nicoll, 1915, 2896 specimens = 80.5% of total trematodes = 74.1% of total parasites;

(b) *Opecoelus* sp. (*O. lobatus* and *O. sphaericus*), 218 specimens = 6.1% of total trematodes = 5.6% of total parasites;

(c) *Dactylostomum gracile* Woolcock, 1935, 69 specimens = 1.9% of total trematodes = 1.8% of total parasites;

(d) *Austrocreadium* sp. Szidat, 1956, 1 specimen = 0.03% of total trematodes = 0.02% of total parasites;

(e) *Monorchis* sp. (Monticelli, 1893), 36 specimens = 1.0% of total trematodes = 0.9% of total parasites;

(f) HEMIURIDAE, 377 specimens = 10.5% of total trematodes = 9.6% of total parasites; they consisted of *Uterovesiculurus yamagutii* Ahmad, 1980; *Erilepturus acanthopagri* n. sp. *Lecithocladium* sp. Lühe, 1901; *Sterrhurus* sp. Looss, 1907 (Yamaguti, 1970) Syn. *Lecithochirium* Lühe, 1901 (Gibson and Bray, 1979); and *Derogenoides* sp.

B. Cestodes, 37 specimens = 1.0% of total parasites; all were larval stages consisting of *Nippotaenia* sp. (Yamaguti, 1939); *Gymnorhynchus* sp., Type 1 Form 1; *Gymnorhynchus* sp., Type 1 Form 2; *Gymnorhynchus* sp., Type 2; and *Proteocephalus* sp.

C. Nematodes, total of 240 specimens = 6.1% of total parasites, comprised of 118 adult specimens = 3.0% of total parasites; and 122 larval forms = 3.1% of total parasites. They consisted of *Terranova* sp., Type 1, larva, Cannon, 1977; *Terranova* sp., Type 2, larva, Cannon, 1977;

Contracaecum sp. (Larva); *Hysterothylacum* sp. Ward and Magath, 1917, Syn. *Thynnascaris* sp., Type 1, larva, Cannon, 1977; *Spirocamallanus* sp.; *Cucullanus acanthopagri* n. sp.; *Cucullanellus acanthopagri* n. sp.; *Indocucullanus* sp.; *Neocucullanellus australis* n. sp.; *Echinocephalus uncinatus*; *Philometra* sp.; and *Philometroides roubali* n. sp.

D. Acanthocephalans, 12 specimens = 0.3% of total parasites, consisting of *Longicollum pagrosomi* Yamaguti, 1935; *L. australis* n. sp.; *Neoechinorhynchus* sp. Hamann, 1892; and *Hexaspiron* sp.

E. Unidentified cyst/larval forms, 25 specimens = 0.6% of total parasites.

4.3 Locality and Number of Parasites

In 26 fish (5.9% of total samples) from Arrawarra Headland examined, 57 specimens of parasites (1.4% of total parasites) were found, consisting of 29 specimens of *Coitocaecum gymnophallum;* 1 specimen of *Dactylostomum gracile*; 2 specimens of *Opecoelus* sp.; 13 specimens of *Monorchis* sp.; 4 specimens of Hemiuridae; and 8 specimens of nematodes.

In 12 fish (2.7%) from Arrawarra Lagoon examined, 7 specimens (0.2% of total parasites) were found, consisting of 5 specimens of *Coitocaecum gymnophallum;* 2 specimens of *Dactylostomum gracile;* and 1 specimen of Hemiuridae.

In 22 fish (4.9%) from Woolooweyah Estuary examined, 74 specimens of parasites (1.9% of total parasites) were found, consisting of 18 specimens of *Coitocaecum gymnophallum;* 53 specimens of nematodes; and 3 specimens of Acanthocephala.

In 9 fish (2.0%) from Yamba examined, 30 specimens of parasites (0.8% of total parasites) were found, consisting of 12 specimens of

Coitocaecum gymnophallum; 2 specimens of *Opecoelus* sp.; 11 specimens of nematodes and 5 specimens of Acanthocephala.

In 1 fish (0.2%) from MaClean examined, 2 specimens of *Coitocaecum gymnophallum* and 10 specimens of nematodes were found (0.3% of total parasites).

In 8 fish (1.8%) from Urunga examined, only 1 specimen of *Coitocaecum gymnophallum* was found (0.02% of total parasites).

In 16 fish (3.6%) from Red Rock National Park examined, 39 specimens of parasites (1.0% of total parasites) were found, consisting of 31 specimens of *Coitocaecum gymnophallum;* 6 specimens of *Opecoelus* sp., 1 cestode and one nematode.

In 351 fish (78.2%) from Red Rock Estuary examined, 3690 specimens of parasites (94.3% of total parasites) were found; they consisted of 2801 specimens of *Coitocaecum gymnophallum* (71.6% of total parasites); 208 specimens of *Opecoelus* sp. (5.3% of total parasites); 66 specimens of *Dactylostomum gracile* (1.7% of total parasites); 1 specimen of *Austrocreadium* sp. (0.02% of total parasites); 22 specimens of *Monorchis* sp. (0.6% of total parasites); 34 specimens of cestodes (0.9% of total parasites); 35 specimens of adult nematodes (0.9% of total parasites); 120 larval nematodes (3.1% of total parasites); 4 specimens of Acanthocephala (0.1% of total parasites) and 25 specimens of unidentified larval/cyst forms (0.6% of total parasites).

4.4 Taxonomy of the Endoparasites of the Black bream

Diagnoses and descriptions of 11 digenetic trematodes, 5 cestodes, 12 nematodes and 4 acanthocephalans in the viscera of the black bream are given in the following.

Although a great number of parasites were recovered in this study, only a small number of them were examined alive. Of 11 species of

digenetic trematodes, only 6 were examined alive, i.e. *Coitocaecum gymnophallum*, Nicoll, 1915; *Opecoelus lobatus*, Ozaki, 1925; *O. sphaericus*, Ozaki, 1925; *Monorchis* sp. (Monticelli, 1893) Looss, 1902; *Austrocreadium* sp.; and *Uterovesiculurus yamagutii* Ahmad, 1980. None of the nematodes, acanthocephalans, and cestodes was found fresh.

All descriptions are based on preserved material unless otherwise stated.

Phylum : PLATYHELMINTHES

Class : TREMATODA

Order : DIGENEA Van Beneden, 1858

Suborder : PROSOSTOMATA Odhner, 1905

Family : OPECOELIDAE Ozaki, 1925

Subfamily: OPECOELINAE Stunkard, 1931

GENUS : *Coitocaecum* Nicoll, 1915

C. gymnophallum Nicoll, 1915

Specimens deposited: W199716, W 199718.

Collection data:

- Number of worms measured : 20 fresh specimens
- Site in host : stomach, pyloric caeca, intestine and rectum

Locality : Arrawarra Headland, Arrawarra Lagoon, Woolooweyah Estuary, Yamba, MaClean, Urunga, Red Rock National Park and Red Rock Estuary (N.S.W.)

Description:

Body oval to elongate oval, unspined, total body length 2213 (1305-3417), maximum width 441 (306-595). Oral sucker subterminal 135 (109-188) x 125 (93-163). Prepharynx very short, (n=2) 33 (17-62) x 33 (10-62). Pharynx well developed, (n=19) 95 (72-124) x 91 (62-114), oesophagus short, (n=17) 82 (41-140) x 47 (12-93). Caeca united posteriorly near posterior extremity, no anus. Acetabulum larger than oral sucker, 178 (130-240) x 160 (45-231), without papilliform marginal projections. Testes postovarian, tandem in posterior half of body; anterior testis 228 (134-331) x 197 (122-298), posterior testis 248 (145-322) x 217 (124-355). Ovary median, postacetabular, just anterior to anterior testis, 153 (72-203) x 110 (78-248). Genital pore located to left of

pharynx. Uterus preovarian, between ovary and acetabulum. Seminal vesicle just postacetabular, behind acetabulum. Vitellaria circumcaecal from posterior end of body to halfway between ovary and acetabulum. Excretory vesicle tubular, reaching ovarian level. Eggs comparatively large 63 (56-74) x 37 (25-41). Massive gland cells surround prepharynx.

Remarks:

Table 4.2 gives morphological comparison between my material, the original material of *C. gymnophallum*, and the related species.

My material agrees in most important characters with *Coitocaecum gymnophallum* described by Nicoll, 1915 in his original description. However, there are differences in measurements, i.e. body width, oral sucker, acetabulum and egg size are larger in Nicoll's specimens than in mine.

C. plagiorchis (Ozaki, 1926), described by Yamaguti, 1934 and 1939a, has a similar egg size to my material, but differs in a shorter body.

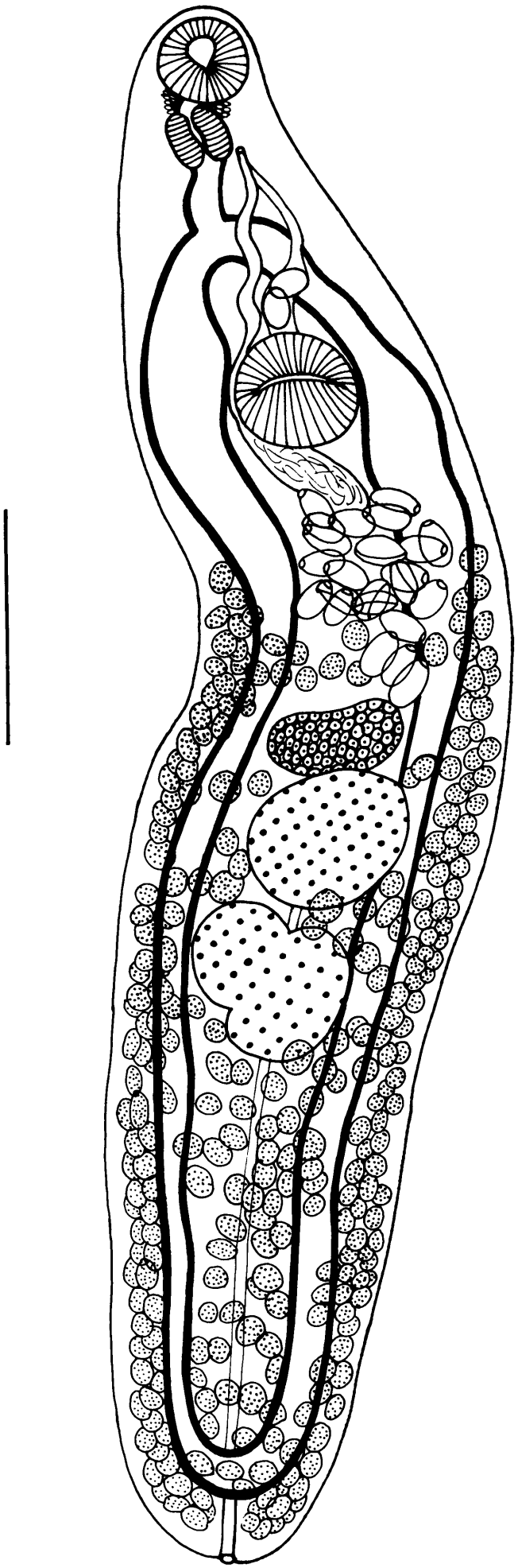
C. glandulosum Yamaguti, 1934, which is considered to be identical with *C. gymnophallum* by Yamaguti, is larger in body dimensions and organ sizes than my material, but it has almost similar testes length and egg size.

Table 4.2 Morphological comparison between specimens of *Coitocaecum gymnophallum* Nicoll, 1915, from northern NSW, Nicoll's original specimens and related species. Measurements are in micrometres unless otherwise indicated.

Characters		Present specimens	*C. gymnophallum* Nicoll, 1915 (mm)	*C. plagiorchis* Ozaki, 1926	*C. plagiorchis* Ozaki, 1926 (mm)	*C. glandulosum* Yamaguti, 1934 (mm)
Body length		2213 (1305-3417)	up to 3 mm	1.04-1.25 mm	0.64-1.68	3.65
Maximum width		441 (306-595)	1/3 body length	0.56-0.57 mm	0.21-0.6	1.16
Oral sucker	(L)	135 (109-188)	0.27	0.13-0.15 mm	-	0.29
	(W)	125 (93-163)	0.31	0.156-0.16mm	0.74-0.16	0.32
Prepharynx	(L)	33 (17-62)	-	-	-	0.05
	(W)	33 (10-62)	-	-	-	-
Pharynx	(L)	95 (50-124)	-	78-84	-	0.24
	(W)	91 (45-114)	-	72-78	0.05-0.1	0.28
Oesophagus	(L)	82 (41-140)	0.06	75-78	-	0.26
	(W)	47 (12-93)	-	-	-	-
Acetabulum	(L)	178 (130-240)	0.43	0.21-0.225 mm	0.11-0.31	0.48
	(W)	160 (45-231)	0.57	0.28-0.29 mm	0.14-0.34	0.55
Ovary	(L)	153 (72-203)	0.12	0.11-0.12 mm	0.045-0.15	0.11
	(W)	110 (78-248)	0.19	0.10-0.12 mm	0.006-0.13	0.36
Anterior testis	(L)	228 (134-331)	-	0.20-0.225 mm	0.063-0.26	0.21
	(W)	197 (122-298)	-	0.15-0.16 mm	0.094-0.20	0.42
Posterior testis	(L)	248 (145-322)	-	0.20-0.225 mm	0.063-0.26	0.23
	(W)	217 (124-355)	-	0.15-0.16 mm	0.094-0.20	0.4
Eggs	(L)	63 (56-74)	0.081-0.084	57-68	0.063 -0.068	0.063-0.07
	(W)	37 (25-41)	0.042-0.043	36-42	0.0368-0.0395	0.039-0.042
Host:		*Acanthopagrus australis*	*Sparus australis*	*Chaenogobius annularis urotaenia*	*Mogurnda obscura Bryttosus kawamebari*	*Epinephelus akaara Sparus macrocephallus*
Site:		stomach, intestine pyloric caeca, rectum	intestine	small intestine	small intestine	small intestine
Locality:		Red Rock Estuary, and other localities of NSW coast	Cleveland Bay, Qld.	Lake Biwa, Japan	Japan	Pacific coast of Wakayama Prefecture and Toyama Bay, Japan
Source:		This study	Nicoll, 1915	Yamaguti, 1939a	Yamaguti, 1934	Yamaguti, 1934

PLATE 2: *Coitocaecum gymnophallum* Nicoll, 1915.

Whole mount, scale length 0.3 mm.



Genus: *Dactylostomum* Woolcock, 1935

D. gracile Woolcock, 1935

Specimens deposited: W199706/7

Collection data:

- Number of worms measured: 5
- Site in host : stomach, intestine, pyloric caeca, rectum
- Locality : Arrawarra Headland, Arrawarra Lagoon, Red Rock Estuary (NSW)

Description:

Body elongate flattened dorso-ventrally, body length 816 (413-1388) maximum width 332 (207-430), tegument smooth, rather thick, unspined. Oral sucker terminating anteriorly, more or less spherical, 119 (93-140) x 111 (85-134). Prepharynx very short, 16 (10-21) x 26 (20-31); pharynx moderately large, subcylindrical, 73 (62-83) x 61 (25-89). Intestinal caeca unbranched, joined at posterior end of body. No anus. Oesophagus short. Acetabulum approximately one-fifth of body length from anterior end, with short pedicle carrying six finger-like outgrowths. Ovary oval, unlobed, 96 (52-145) x 48 (17-64). Testes two, tandem, almost contiguous with each other, postovarian; anterior testis 146 (78-171) x 76 (31-145); posterior testis 147 (76-207) x 71 (33-99). Genital pore to left of pharynx. Siminal vesicle behind acetabulum. Uterus between intestinal bifurcation and ovary. Vitellaria from level of uterus to end of body, consist of two rows of follicles at each side of body parallel to edge of body; follicles oval-shaped. Eggs not numerous, comparatively large, 59 (41-66) x 35 (25-41). Excretory vesicle I-shaped, reaching to posterior level of ovary.

Remarks:

Most characters of my material are similar to those of *Dactylostomum gracile* Woolcock, 1935 except that my material is smaller than Woolcock's. For example, the egg size of my material is 59 (41-66) x 35 (25-41) compared with 70 to 80 by 50 to 60 in Woolcock's material. There are other differences between Woolcock's material and mine, i.e. the position of the intestinal bifurcation which is anterior to the acetabulum in Woolcock's, whereas it is posterior to the acetabulum in my specimens. In *D. vitellosum* Manter, 1940, the vitellaria are of irregular shape and have a scattered distribution, whereas in *D. gracile*, they are regularly oval and arranged in two lateral rows as well as intercaecally.

Table 4.3 Morphological comparison between specimens of *Dactylostomum gracile* Woolcock, 1935, from NSW, original specimens of Woolcock (1935) and *D. vitellosum* Manter, 1940. Measurements are in micrometres unless otherwise indicated.

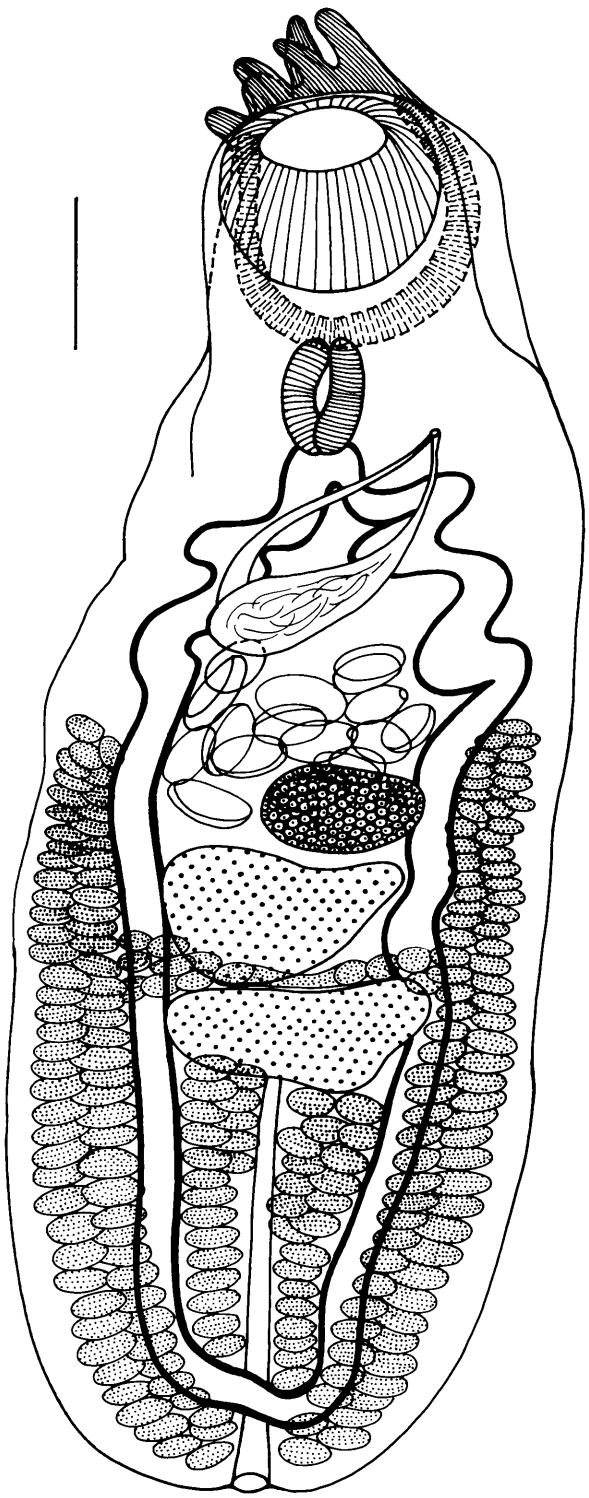
Character		Present specimens	*D. gracile* Woolcock, 1935	*D. vitellosum* Manter, 1940
Body length		816 (207-1388)	4 (2.5-5.0)mm	1.755 mm
Maximum width		332 (207-430)	0.5 (0.35-0.65)mm	0.352 mm
Oral sucker	(L)	119 (93-140)	-	0.119 mm
	(W)	111 (85-134)	-	-
Prepharynx	(L)	16 (10-21)	very short	very short
	(W)	26 (20-31)	-	-
Pharynx	(L)	73 (62-83)	subcylindrical	0.060 mm
	(W)	61 (25-89)		0.076 mm
Acetabulum	(L)	169 (122-190)	-	0.180 mm
	(W)	156 (101-186)	-	-
Ovary	(L)	96 (52-145)	-	-
	(W)	48 (17-64)	-	-
Anterior testis	(L)	146 (78-171)	-	-
	(W)	76 (31-145)	-	-
Posterior testis	(L)	147 (76-207)	-	-
	(W)	71 (33-99)	-	-
Eggs	(L)	59 (41-66)	70-80	53-54
	(W)	35 (25-41)	50-60	27-30
Host:		*Acanthopagrus australis*	Sand mullet (*Myxus elongatus*)	small silver tide-pool fish
Site:		stomach, intestine, pyloric caeca, rectum	stomach, pyloric caeca, intestine	intestine
Locality		Red Rock Estuary, Red Rock National Park. Woolooweyah Estuary, Arrawarra Headland, Yamba (NSW)	Port Philip Bay, Victoria	Gorgona Island, Columbia
Source:		This study	Woolcock, 1935	Manter, 1940

PLATE 3: *Dactylostomum gracile* Woolcock, 1935

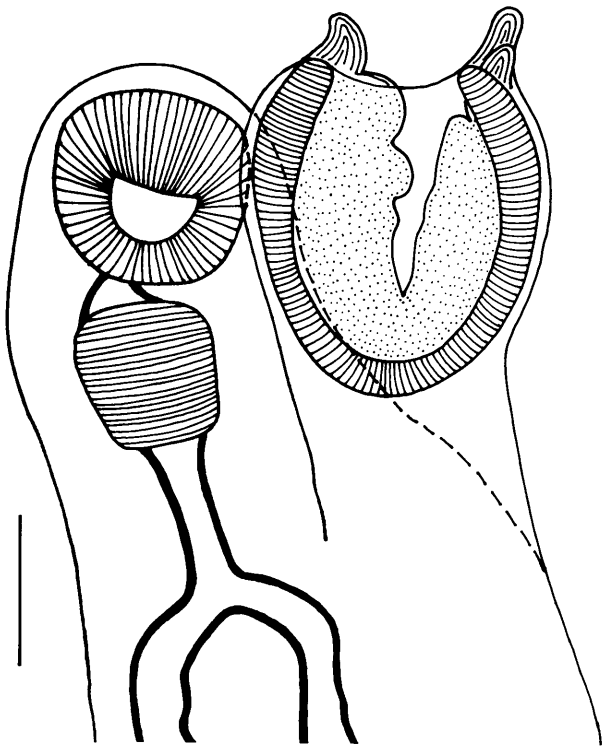
A. Whole mount, ventral view.

B. Head and acetabulum with finger-like outgrowths/papillae, ventrolateral view.

Scale length 0.1 mm.



A



B

Genus: *Opecoelus* Ozaki, 1925

O. lobatus Ozaki, 1925

Specimens deposited: W199713

Collection data:

- Number of worms measured: 19 fresh specimens
- Site in host : stomach, intestine, pyloric caeca, rectum
- Locality : Arrawarra Headland, Yamba, Red Rock National Park and Red Rock Estuary (N.S.W.)

Description:

Body elongate, anterior and posterior ends rounded, total length 1200 (488-1926); maximum width 301 (126-463). Tegument smooth, unspined. Oral sucker subterminal, 116 (56-161) x 101 (54-134). Prepharynx very short, (n=7) 22 (17-39) x 38 (17-68); pharynx well developed, elliptical, 77 (31-114) x 74 (41-107). Oesophagus short, (n=18) 57 (21-97) x 25 (10-41). Acetabulum prominent with short pedicle and with 6 (3 pairs) finger-like marginal papillae, 169 (87-223) x 160 (68-223). Caeca united posteriorly near posterior extremity, with anus opening ventrally. Testes two, deeply lobed, postovarian, tandem; anterior testis 113 (43-231) x 106 (58-147); posterior testis 123 (56-231) x 113 (56-149); testes almost contiguous. Posterior end of seminal vesicle just behind acetabulum; genital pore anterior to intestinal bifurcation, left of oesophagus. Ovary lobed, 76 (21-149) x 74 (35-124) in front of anterior testis. Uterus between ovary and acetabulum. Vitellaria winding from level of posterior end of seminal vesicle to posterior end of body, consisting of regular and uniformly shaped follicles. Eggs 60 (52-66) x 37 (23-41). Excretory pore I-shaped, reaching to level of ovary.

Remarks:

The present specimens of *Opecoelus lobatus* Ozaki, 1925 agree in all important characters with Ozaki's material in his original description, and with that described by Ozaki (1929) and Yamaguti (1934, 1940).

However, there are some differences in measurements. My material is shorter than Ozaki's (1925, 1929) and Yamaguti's (1934, 1940). Ozaki's original specimens are also wider, and they have a longer oesophagus than mine.

To my knowledge, this is the first record of *O. lobatus* from the black bream.

Table 4.4 Morphological comparison between specimens of *Opecoelus lobatus* Ozaki, 1925 from N.S.W. and other localities. Measurements are in micrometres unless otherwise indicated.

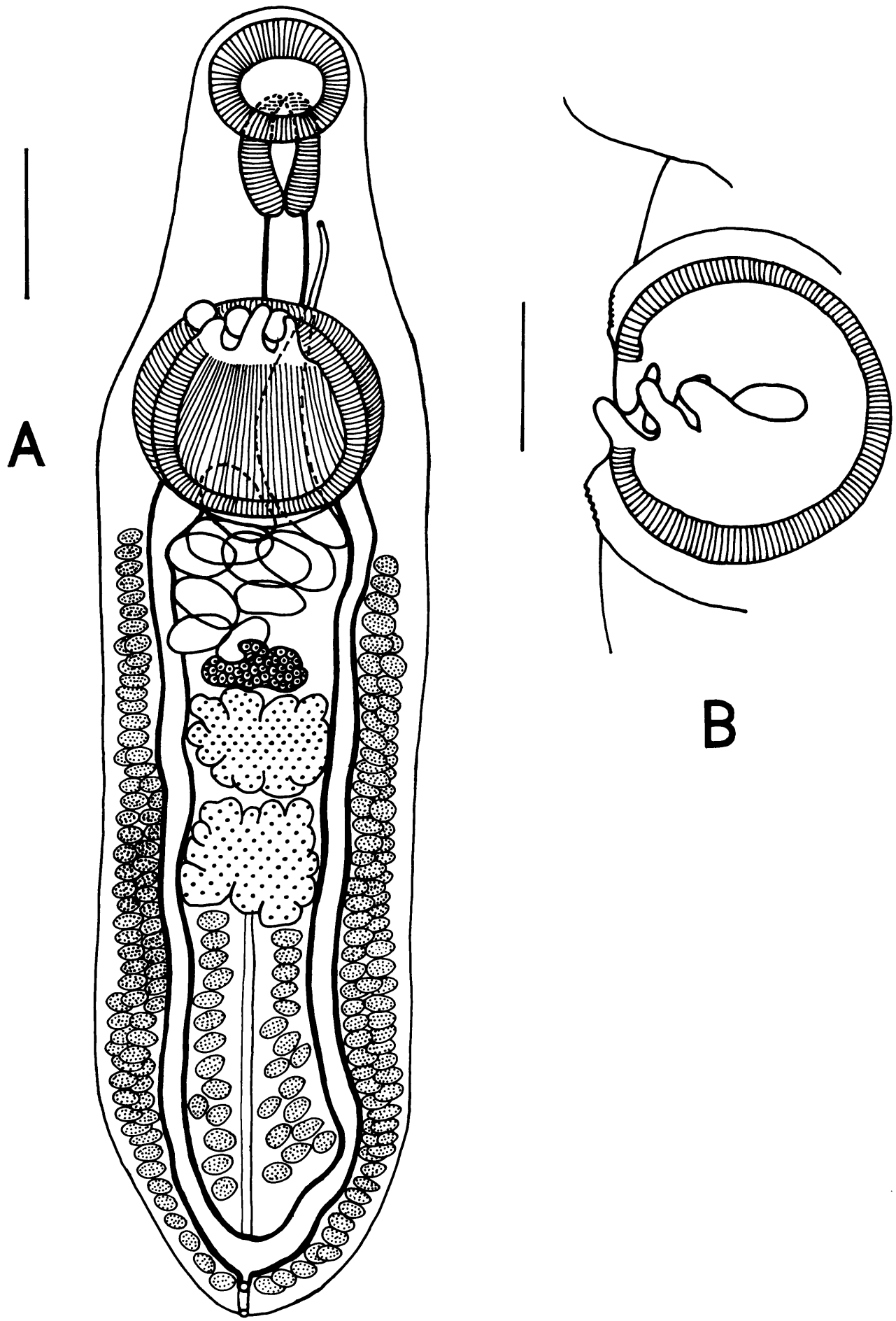
Character		Present specimens	Ozaki (1925)	Ozaki (1929)	Yamaguti (1934)	Yamaguti (1940)
Body length		1200 (488-1926)	2.2-3.6 mm	2.25-3.8 mm	1.82-4.77 mm	1.8-2.3 mm
Maximum width		301 (126-463)	0.50-0.51 mm	0.50-0.65 mm	-	0.28-0.38 mm
Oral sucker	(L)	116 (56-161)	0.16-0.17	0.16-0.18	-	0.10-0.125 mm
	(W)	101 (54-134)	(diameter)	(diameter)	-	0.12-0.14 mm
Prepharynx	(L)	22 (17-39)	-	short	-	-
	(W)	38 (17-68)	-	-	-	-
Pharynx	(L)	77 (31-114)	0.08-0.10 mm	0.10-0.10 mm	-	75-96
	(W)	74 (41-107)	-	0.08-0.14 mm	-	66-80
Oesophagus	(L)	57 (21-97)	-	0.15-0.25 mm	-	30-110
	(W)	25 (10-41)	-	-	-	-
Acetabulum	(L)	169 (87-223)	0.24-0.27 mm	0.24-0.29 mm	-	0.18-0.20 mm
	(W)	160 (68-223)	(diameter)	(diameter)	-	(diameter)
Ovary	(L)	76 (21-149)	-	0.08-0.13 mm	-	70-80
	(W)	74 (35-124)	-	0.20-0.30 mm	-	120-150
Anterior testis	(L)	113 (43-231)	irregularly lobed	deeply lobed	-	0.12-0.16 mm
	(W)	106 (58-147)	-	-	-	0.11-0.156 mm
Posterior testis	(L)	123 (56-231)	irregularly lobed	deeply lobed	-	0.12-0.16 mm
	(W)	113 (56-149)	-	-	-	0.11-0.156 mm
Eggs	(L)	60 (52-66)	60-70	0.06-0.065 mm	0.068 mm	70-80
	(W)	37 (23-41)	40-44	0.033-0.04 mm	0.036 mm	120-150 mm
Host		*Acanthopagrus australis*	*Parapristipoma trilineatum*	*Parapristipoma trilineatum* *Trachurus japonicus*	*Parapristipoma trilineatum* *Epinephelus akaara*	*Epinephelus akaara*
Site		Stomach, intestine, pyloric caeca, rectum.	intestine	intestine, pyloric caeca	small intestine,	intestine
Locality		Red Rock Estuary, Red Rock National Park, Woolooweyah Estuary, Arrawarra Headland, Yamba (N.S.W.)	Chosi, Ibaraki Prefecture Japan	Chosi, Ibaraki Prefecture Japan	Inland Sea of Japan	Hamazima, Japan
Source		This study	Ozaki, 1925	Ozaki, 1929	Yamaguti, 1934	Yamaguti, 1940

PLATE 4: *Opecoelus lobatus* Ozaki, 1925

A. Whole mount, ventral view;

B. Acetabulum, lateral view.

Scale length 0.1 mm.


A
B

Genus: *Opecoelus* Ozaki, 1925

O. sphaericus Ozaki, 1925

Specimens deposited: No. not yet available.

Collection data:

- Number of worms measured: 13 fresh specimens
- Site in host : stomach, intestine, pyloric caeca, rectum
- Locality : Arrawarra Headland, Yamba, Red Rock National Park and Red Rock Estuary (NSW)

Description:

Body elongated cylindrical, posterior part of body slightly flattened dorso-ventrally; anterior part bluntly pointed, posterior part rounded. Body length 1429 (891-2340), maximum width 317 (215-405). Tegument thin, unspined. Oral sucker subterminal, 110 (83-140) x 110 (70-128). Pre-pharynx short (n=11) 26 (12-45) x 31 (14-66). Pharynx well developed 78 (58-118) x 88 (60-130). Oesophagus short (n=11) 76 (45-143) x 32 (21-62). Acetabulum 142 (116-176) x 139 (116-178) about one-third of body length behind anterior end, with short pedicle and 6 (3 pairs) short finger-like marginal papillae. Ovary pretesticular, just in front of anterior testis, 82 (50-145) x 85 (45-140). Uterus preovarian, between ovary, short. Vitellaria from level between ovary and acetabulum to end of body, with spherical follicles. Eggs 64(56-74) x 40 (35-45). Testes two, spherical, tandem, in anterior part of posterior half of body. Anterior testis 137 (83-223) x 140 (81-207); posterior testis 142 (78-240) x 148 (81-231). Genital pore anterior to intestinal bifurcation to left of pharynx. Caeca united posteriorly, with anus opening ventrally near posterior extremity.

Remarks:

All important characters of my material agree with those of *Opecoelus sphaericus* Ozaki, 1925, either in Ozaki's original description or in others, i.e. Ozaki (1929) and Yamaguti (1934, 1940). Nevertheless, there are differences in measurements especially in body length and maximum width of the body. The specimens of Ozaki (1925, 1929) and Yamaguti (1934, 1940) have larger body length and maximum body width than my material.

Acanthopagrus australis is a new host record for *O. sphaericus*, as well as for *O. lobatus*.

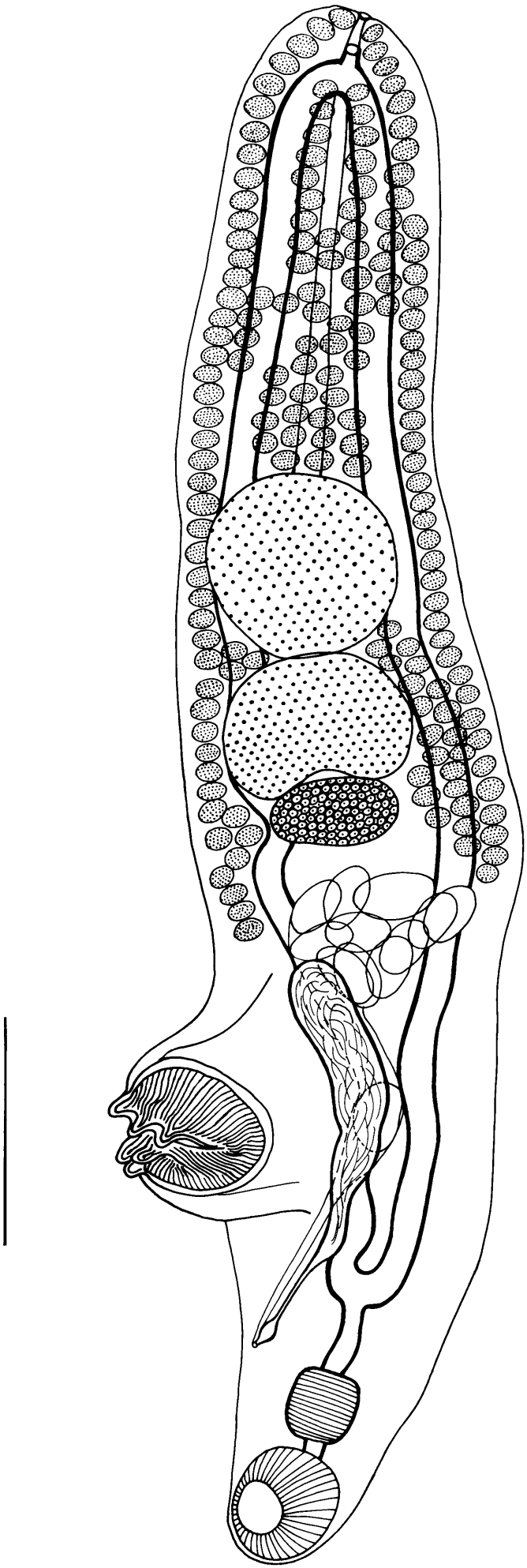
Table 4.5 Morphological comparison between specimens of *Opecoelus sphaericus* Ozaki, 1925 from NSW and other localities. Measurements are in micrometers unless otherwise indicated.

Character		Specimens from NSW	Ozaki (1925)	Ozaki (1929) (mm)	Ozaki (1929) (mm)	Yamaguti (1934) (mm)	Yamaguti (1940)
Body length		1429 (891-2340)	4.35-8.25 mm	4.3-8.25	4.3-8.25	3.4-4.1	2.65-2.8 mm
Maximum width		317 (215-405)	0.35-0.95 mm	0.35-0.95	0.35-0.95	0.25-0.43	0.42-0.50 mm
Oral sucker	(L)	110 (83-140)	0.18-0.37 mm	0.22-0.32	0.23-0.32	0.13-0.18	0.138-0.15 mm
	(W)	110 (70-128)	(diameter)	0.23-0.36	0.23-0.36	(across)	0.14-0.156 mm
Prepharynx	(L)	26 (12-45)	0.04-0.22 mm	0.04-0.22	very short	-	-
	(W)	31 (14-66)	-	-	-	-	-
Pharynx	(L)	78 (58-118)	0.12-0.20 mm	0.14-0.22	0.14-0.22	0.08-0.13	0.12-0.13 mm
	(W)	88 (60-130)	0.13-0.22 mm	0.12-0.24	0.12-0.24	0.08-0.11	0.10-0.126 mm
Oesophagus	(L)	76 (45-143)	0.14-0.26 mm	0.24-0.14-	0.24	-	0.125-0.15 mm
	(W)	32 (21-62)	-	0.26)	-	-	-
Acetabulum	(L)	142 (116-176)	0.20-0.37 mm	0.23-0.57	0.2-0.37	0.15-0.21	0.238-0.27 mm
	(W)	139 (116-178)	(diameter)	0.3 -0.38	(diameter)	(across)	(diameter)
Ovary	(L)	82 (50-145)	trilobed	0.18-0.30	0.18-0.3	0.11-0.18	0.09-0.11 mm
	(W)	85 (45-140)		trilobed	(diameter)	(across)	0.15-0.2 mm
Anterior testis	(L)	137 (83-223)	globular to	0.32-0.41	0.36-1.03	0.29-0.34	0.13-0.32 mm
	(W)	140 (81-207)	elliptical	0.24-0.28	(diameter)	0.13-0.29	0.22-0.26 mm
Posterior testis	(L)	142 (78-240)	globular to	0.32-0.41	0.36-1.03	0.29-0.34	0.13-0.32 mm
	(W)	148 (81-231)	elliptical	0.24-0.28	(diameter)	0.13-0.29	0.22-0.26 mm
Eggs	(L)	64 (56-74)	70-71	0.075(0.072-0.081)	0.072-0.081	0.072-0.075	57-63
	(W)	40 (35-45)	44-46	0.043(0.044-0.047)	0.044-0.047	0.041-0.042	34-38
Host:		*Acanthopagrus australis*	*Leptocephalus myriaster*	*Leptocephalus myriaster* (Zoological Inst. Tokyo)	*Leptocephalus myriaster*	*Hexagrammos otakii* (matures) *Girella punctata* (immatures)	Black eel
Site:		stomach, intestine, pyloric caeca, rectum	intestine	intestine	intestine	intestine	intestine
Locality		Red Rock Estuary, Red Rock Nat.Park Wooloowehah Estuary, Arrawarra H'land Yamba (NSW)	Takamatsu Kagawa Prefecture, Japan	Takamatsu Mitsugama, Onomichi Simonoseki, Japan	Takamatsu Kagawa Prefecture, Japan	Toyama Bay Japan	Hamazima Mie Prefecture, Japan
Source:		This study	Ozaki, 1925	Ozaki, 1929	Ozaki, 1929	Yamaguti, 1934	Yamaguti, 1940

PLATE 5: *Opecoelus sphaericus* Ozaki, 1925.

Whole mount, ventral view.

Scale length 0.2 mm.



Family : ALLOCREADIIDAE (Looss, 1902) Stossich, 1903

Subfamily : ALLOCREADIINAE Looss, 1902

Genus : *Austrocreadium* Szidat, 1956

Austrocreadium sp.

Specimen deposited: No. not yet available.

Collection data:

- Number of worms measured: 1 fresh specimen
- Site in host : intestine
- Locality : Red Rock Estuary (N.S.W.)

Description:

Body fusiform, slightly elongated, without spines, total length 1471; maximum width 355 at level between intestinal bifurcation and acetabulum. Oral sucker subterminal, with 3 pairs of short appendages, oral sucker length (to tip of lip papillae) 120, and (to base of lip papillae) 114, oral sucker width 114. Prepharynx distinct but short, wider than long, 31 x 41. Pharynx well developed, 72 x 68. Oesophagus 62 x 25. Acetabulum relatively small, without papillae, 128 x 114, slightly larger than oral sucker. Ovary pretesticular, slightly in front of anterior testis, 112 x 43. Anterior testis rounded, 130 x 128; posterior testis more rectangular, obliquely behind anterior testis, 124 x 120. Caeca united posteriorly, near posterior extremity, without anus. Excretory vesicle I-shaped tubular, reaching to posterior level of posterior testis. Seminal vesicle long, saccular, to left of acetabulum, 107 x 33. Genital pore to right of oesophagus between intestinal bifurcation and posterior end of pharynx. Vitellaria follicular, follicles not uniform in shape, winding from posterior extremity to level of uterus. Uterus short, between ovary and acetabulum. Eggs comparatively large, few in number, 64 (60-68) x 33.

Remarks:

My specimen of *Austrocreadium* sp. resembles *A. papilliform* Szidat, 1956 from Argentina in having one oral sucker surmounted with three pairs of lip papillae on each side. It differs, however, in having no body spines and in the situation of the genital pore which is just preacetabular in Szidat's specimens and to the right of the oesophagus in mine. Furthermore, whereas my specimen has posteriorly united caecae, Szidat's specimens have two caeca ending blindly. Also the egg size of my specimen is smaller than that of Szidat's specimen (95 x 48 µm in Szidat's and 64 (60-68) x 33 µm in my specimen).

My specimen is very likely a new species; however, a new species is not established because only a single specimen is available. In addition, geographical variation of a single species with wide distribution cannot be excluded.

Table 4.6 List of measurements of *Austrocreadium* sp. Measurements are in micrometres.

Characters			
Body length		1471	
Maximum width		355	
Oral sucker	(L)	107	to base of lip papillae
		120	to tip of lip papillae
	(W)	114	
Prepharynx	(L)	31	
	(W)	41	
Pharynx	(L)	72	
	(W)	68	
Oesophagus	(L)	62	
	(W)	25	
Acetabulum	(L)	128	
	(W)	114	
Ovary	(L)	112	
	(W)	43	
Anterior testis	(L)	130	
	(W)	128	
Posterior testis	(L)	124	
	(W)	120	
Eggs	(L)	64 (60-68)	
	(W)	33	

Note: Based on single specimen found in the intestine.

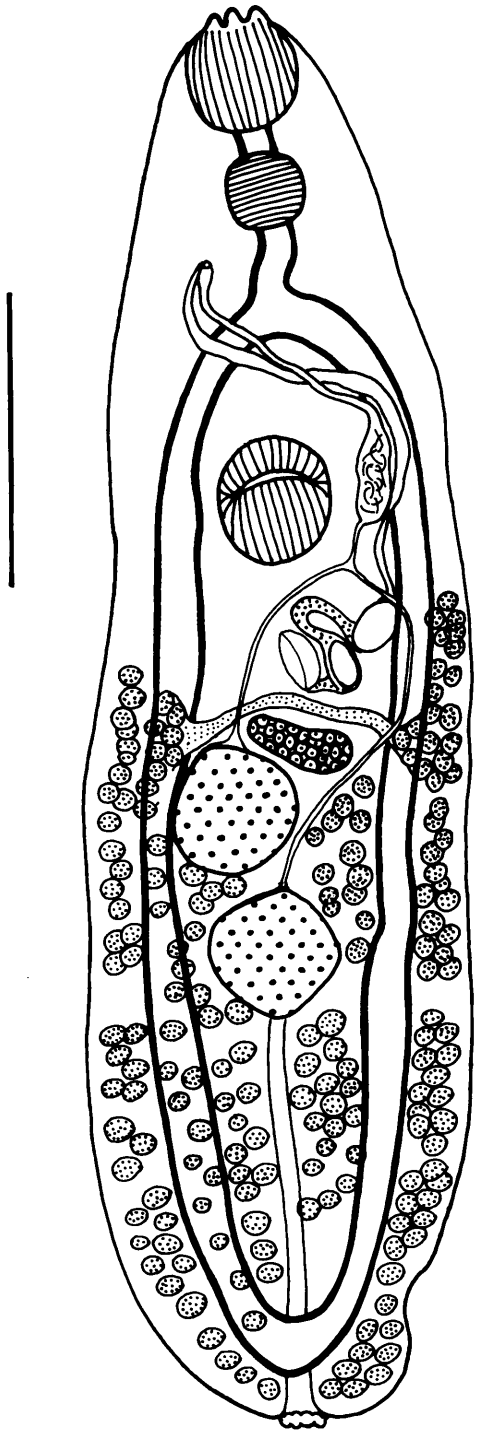
Locality: Red Rock Estuary.

PLATE 6: *Austrocreadium* sp.

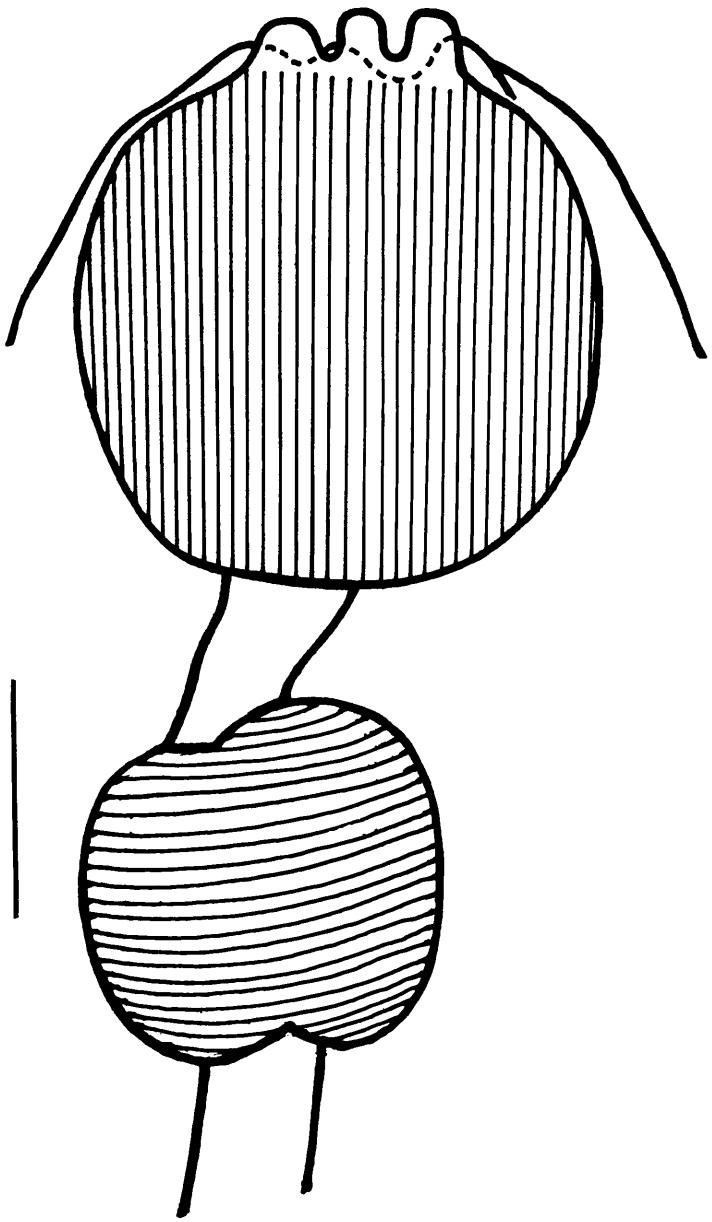
A. Whole mount, ventral view.

B. Oral sucker with three pairs of lip papillae.

Scale length A - 0.3 mm, B - 0.05 mm.



A



B

Family : MONORCHIIDAE Odhner, 1911

Subfamily : MONORCHIINAE (Odhner, 1911) Nicoll, 1915

Genus : *Monorchis* (Monticelli, 1893) Looss, 1902

Monorchis sp.

Specimens deposited: No. not yet available.

Collection data:

- Number of worms measured: 3
- Site in host : intestine
- Locality : Red Rock Estuary and Arrawarra Headland (NSW)

Description:

Body small, oval to very slightly elongated, with spines less dense posteriorly, 413 (405-413) x 284 (231-314). Oral sucker subterminal, slightly wider than long, 95 (85-103) x 86 (78-93). Pharynx 53 (45-62) x 48 (37-56). Oesophagus short, seen only in living specimen. Caeca terminate close to posterior end of body. Acetabulum preequatorial, 62 (41-83) x 48 (33-62). Single testis, large, median, transversely elongated, postequatorial, 97 (62-145) x 94 (70-109). Cirrus sac 89 (89-89) x 50 (41-58) posterior and lateral to acetabulum with saccular seminal vesicle and bulbous pars prostatica. Genital atrium 58 x 52 (seen clearly only in 1 living specimen). Terminal organ almost as large as genital atrium, posterolateral to acetabulum, 58 (52-64) x 57 (56-58). Genital pore submedian at midlevel of acetabulum. Ovary post-testicular, very wide, overlapping both caeca. Vitellaria in lateral field at level anterior to pharynx. Uterus between level of acetabulum and just posterior to ovary. Eggs operculate, 25 x 17. Excretory vesicle Y-shaped.

Remarks:

My specimens of *Monorchis* sp. are similar in most characters to *Monorchis heterorchis* (Bilqees, 1980). However, they are smaller than *M. heterorchis*. My specimens also differ from Bilqees' specimens in the position and shape of the ovary which is posttesticular, unlobed and wide in mine, and pretesticular, consisting of four lobes and less wide, in Bilqees' materials.

My material differs from *M. latus* Manter, 1942, in having the widest part in the middle of the body, whereas Manter's material has the widest part of the body near the posterior end of the body. My specimens are also smaller than Manter's. Whereas my specimens have a transversely elongate testis, Manter's specimens have an ovoid testis. The pars prostatica is bulbous in my material, but elongate in *M. latus*.

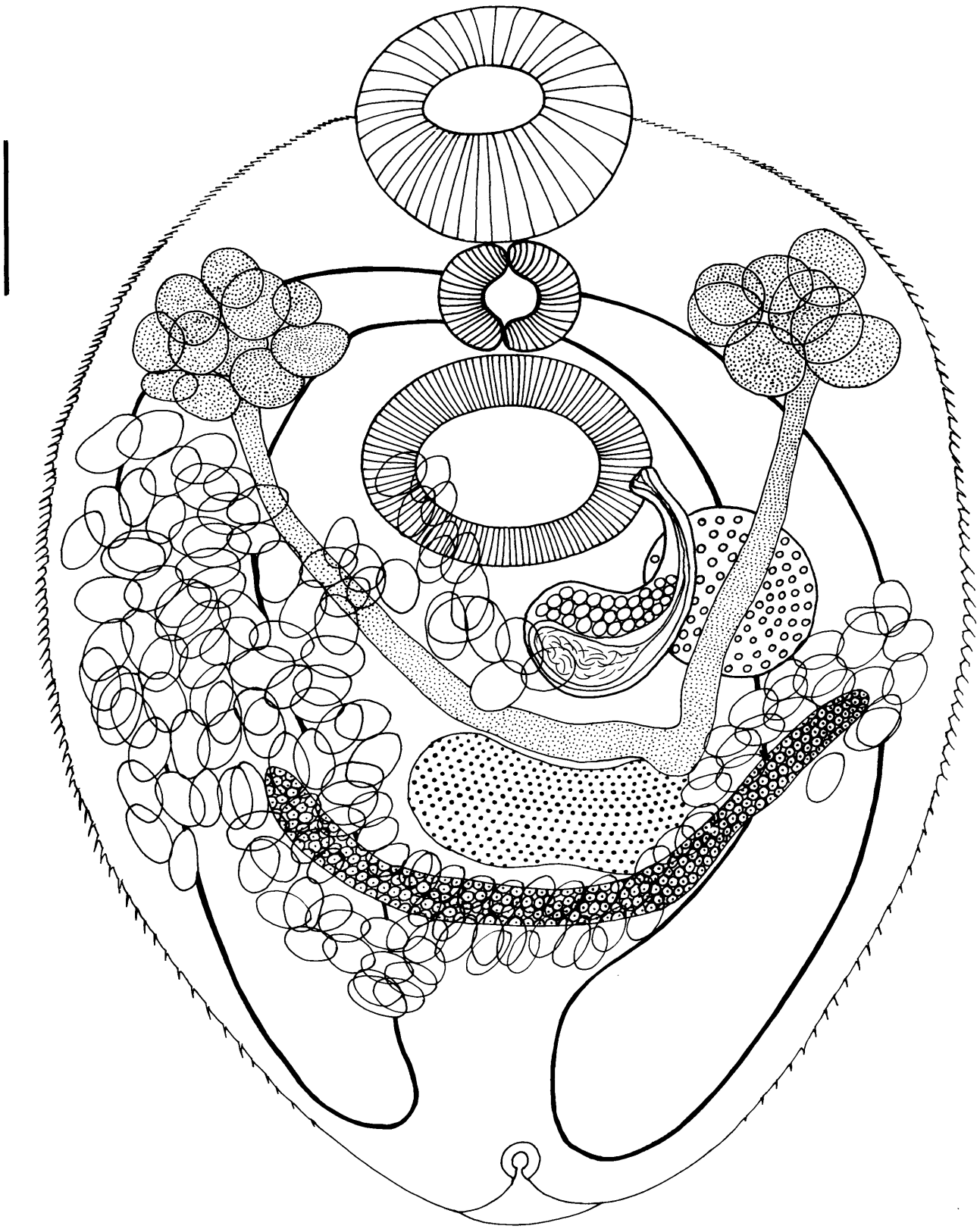
Table 4.7 Morphological comparison between *Monorchis* sp. and related species. Measurements are in micrometres.

Characters		*Monorchis* sp.	*M. latus*, Manter, 1942	*M. heterorchis*, Bilqees, 1980
Body length		408 (405-413)	438-710	1700-2400
Maximum width		284 (231-314)	544-710	1000-1400
Oral sucker	(L)	95 (89-103)	74-105	150-200
	(W)	86 (78-93)	(diameter)	(diameter)
Pharynx	(L)	53 (45-62)	41-48	110-140
	(W)	48 (37-56)	41-51	120-140
Oesophagus	(L)	25	-	-
	(W)	21	-	-
Acetabulum	(L)	62 (41-83)	100-130	48-74
	(W)	48 (33-62)	(diameter)	(diameter)
Testis	(L)	97 (62-145)	-	-
	(W)	94 (70-109)	-	-
Cirrus sac	(L)	89	-	-
	(W)	50 (41-58)	-	-
Ovary		posttesticular transversely elongated, unlobed	of three distinct almost separated lobes, to the right, pre-testicular	pretesticular four lobes
Host:		*Acanthopagrus australis*	*Anisotremus virginicus* *Haemulon plumieri*	*Muraenesox cinereus*
Site:		intestine	intestine	intestine
Locality		Red Rock Estuary, NSW	Tortugas, Florida, USA	West Wharf, Karachi coast, Pakistan
Source		This study	Manter, 1942	Bilqees, 1980

PLATE 7: *Monorchis* sp. (Monticelli, 1893) Looss, 1902

Whole mount, ventral view.

Scale length 0.05 mm.



Superfamily: HEMIUROIDEA Looss, 1899

Family : HEMIURIDAE Looss, 1899

Subfamily : DINURINAE Looss, 1907

Genus : *Uterovesiculurus* Skrjabin and Guschanskaja, 1954

U. yamagutii Ahmad, 1980

Specimens deposited: W199705.

Collection data:

- Number of worms measured: 1 fresh specimen
- Site in host : stomach
- Locality : Red Rock Estuary (NSW)

Description:

Body smooth, elongate, with evaginated ecsoma. Body length 2941 and maximum width 787. Oral sucker more or less spherical, subterminal, 331 x 307, inconspicuously surmounted by preoral lobe. Prepharynx indistinct. Pharynx 83 x 107. Oesophagus inconspicuous. Intestinal caeca long, reaching ecsoma or posterior end of body. Acetabulum almost spherical, larger than oral sucker, in middle third of body, 521 x 479. Testes two, oval, postacetabular, almost symmetrical, well separated from each other and from acetabulum. Right testis almost contiguous with ovary, 132 x 91. Seminal vesicle undivided, slightly behind acetabulum, 298 x 74. Vas deferens long. Pars prostatica, distal portion slightly swollen, surrounded by large number of prostate gland cells. Genital pore short distance behind pharynx. Ovary posttesticular, in contact with right testis, oval, 207 x 165. Seminal receptacle (?). Vitellaria consist of seven tubular lobes, three on left and four on right. Uterus coiled with numerous small eggs. Eggs 17 x 10. Excretory vesicle Y-shaped; excretory pore dorsal near posterior end of ecsoma; excretory arms united at level of oral sucker.

Remarks:

In general my specimen of *Uterovesiculurus* sp. agrees with the description of *U. yamagutii* recovered from *Saurus myops* (Bl. Schn.) in the Bay of Bengal by Jamil Ahmad, 1980, except for some minor differences in organ dimensions, in the longer caeca and the non-bipartite seminal vesicle.

My specimen is tentatively assigned to *U. yamagutii*.

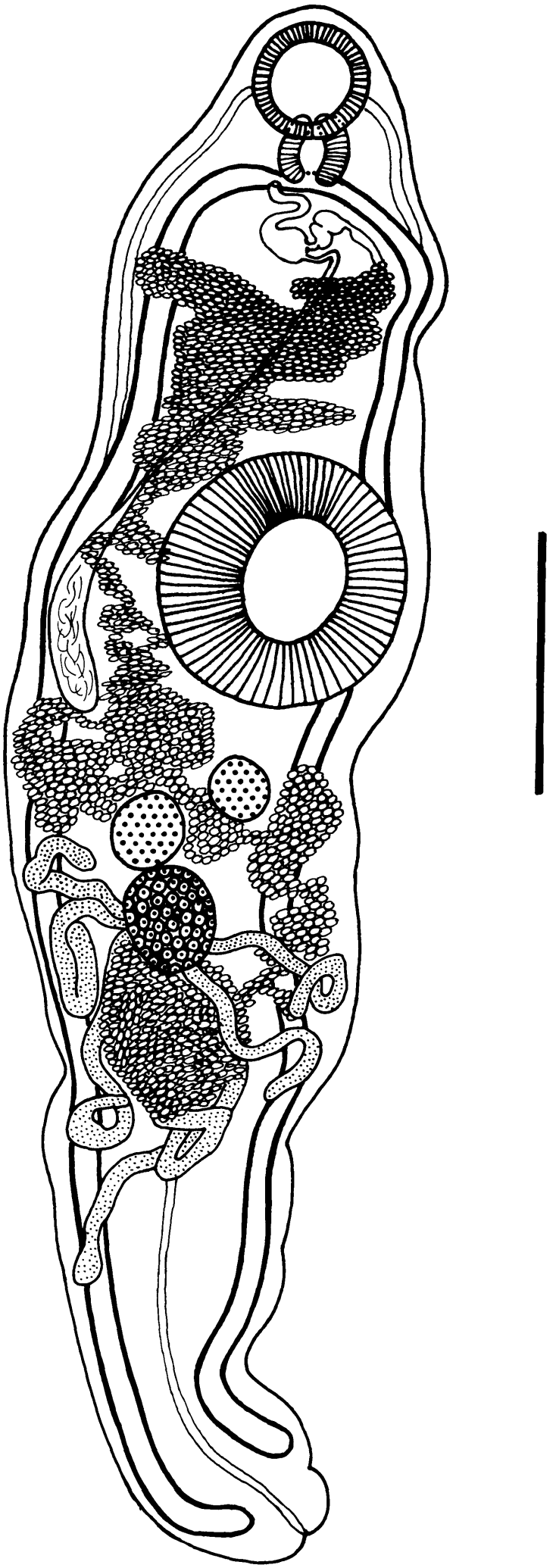
Table 4.8 Comparison of measurements between the NSW specimen and Ahmad's specimens of *Uterovesiculurus yamagutii*. Measurements are in micrometres unless otherwise indicated.

Character		Present specimen	Ahmad (1980)
Body length		2941	2.93-3.25 mm
Maximum width		787	1.11-1.455 mm
Oral sucker	(L)	331	270
	(W)	307	310
Pharynx	(L)	83	120-170
	(W)	107	140-150
Acetabulum	(L)	521	590-620
	(W)	479	590-620
Seminal vesicle	(L)	298	270-388
	(W)	74	240-130
Left testis	(L)	132	192-290
	(W)	91	300-360
Right testis	(L)	124	220-270
	(W)	107	240-400
Ovary	(L)	207	200-380
	(W)	165	290-580
Ecsoma	(L)	891	-
Egg(S)	(L)	17	18-22
	(W)	10	10-12
Host:		*Acanthopagrus australis*	*Saurus myops*
Site:		stomach	stomach
Locality:		Red Rock Estuary, NSW	Bay of Bengal, Puri coast, Orissa
Source:		This study	Ahmad, 1980

PLATE 8: *Uterovesiculurus yamagutii* Ahmad, 1980

Whole mount, ventral view.

Scale length 0.5 mm.



Genus: *Erilepturus* Woolcock, 1935

E. acanthopagri n.sp.

Specimens deposited: W199717.

Collection data:

- Number of worms measured: 2 fresh specimens
- Site in host : stomach
- Locality : Red Rock Estuary (NSW)

Description:

Body elongate, slender, cylindrical, tegument without transverse plications; total length 1191 (953-1429), maximum width 261 (248-273). Ecsoma envaginated, 301 (165-446) from posterior end of body. Oral sucker subterminal, almost spherical, with preoral lobe, 66 x (48-54). Prepharynx lacking or indistinct. Pharynx 41 (37-45) x 39 (37-41). Oesophagus short, 36 (27-39) x 18 (17-19). Acetabulum larger than and well apart from oral sucker, spherical, 166 (151-184) x 165 (151-178). Sucker ratio 1:2.51-3.24. Testes two, diagonal, not very close to each other, median in middle of body, postacetabular; right testis 58 (48-68) x 61 (48-74); left testis 68 (60-67) x 49 (25-72). Vas deferens short. Seminal vesicle slightly postacetabular, undivided, its basal end lateral to testes. Genital pore ventral to oral sucker, just posterior to mouth. Ovary median, approximately ovoid, posttesticular, contiguous with right testis, 76 (60-91) x 86 (66-105). Vitellaria immediately behind ovary, consist of seven lobed masses of irregular shape. Uterus coiled from anterior end of acetabulum to level of end of caeca not reaching ecsoma. Eggs small, numerous, 19 x 10. Excretory vesicle Y-shaped, its arms uniting at level of oral sucker, excretory pore near end of body (in ecsoma).

Remarks:

My specimens closely resemble *Erilepturus synodi* Yamaguti, 1970, found in the stomach of *Synodus dermatogenys* in Hawaii, and *E. tiegsi* Woolcock, 1935, found in the stomach and intestine of the salmon trout (*Arripis trutta*) from Port Phillip Bay, Victoria. However, my specimens are smaller than both Yamaguti's and Woolcock's. They also differ from Woolcock's and Yamaguti's specimens in having the genital pore ventral to the oral sucker, compared with Woolcock's and Yamaguti's which have the genital pore behind the pharynx and ventral to the pharynx respectively.

Whereas my specimens have an undivided seminal vesicle, Woolcock's specimens have a tripartite seminal vesicle.

The differences justify the establishment of a new species, for which I propose the name *Erilepturus acanthopagri*. The species name refers to the host genus.

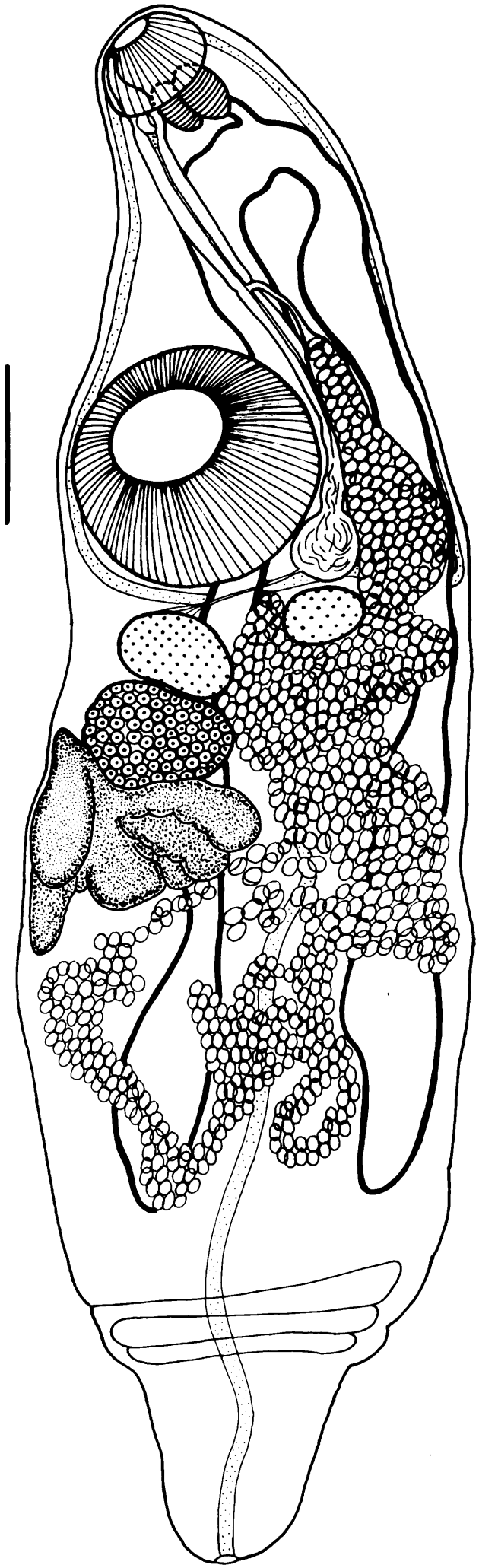
Table 4.9. Morphological comparison between *Erilepturus acanthopagri* n. sp. and related species. Measurements are in micrometres unless otherwise indicated

Character		*E. acanthopagri*	*E. tiegsi* Woolcock, 1935	*E. aequalis* Yamaguti, 1970	*E. synodi* Yamaguti, 1970	*E. trachinocephali* Yamaguti, 1970
Body length		1191 (953-1429)	4.0-6.5 mm	2.25 mm	3.8-5.3 mm	1.4-6.0 mm
Maximum width		261 (248-273)	1.5-2 mm	0.4 mm	1.0-1.3 mm	0.4-1.4 mm
Cuticle		not plicated	not plicated	thin, smooth	thick, smooth	finely annulated transversely
Oral sucker	(L)	66	small, globular, subterminal	0.25 mm	0.15-0.24 mm	0.11-0.26 mm
	(W)	52 (48-54)		0.28 mm	0.2-0.3 mm	0.13-0.29 mm
Prepharynx		indistinct	lacking	-	-	-
Pharynx	(L)	41 (37-45)	0.16 mm	0.1 mm	80-110	0.06-0.12 mm
	(W)	39 (37-41)		0.11 mm	100-120	0.07-0.16 mm
Oesophagus	(L)	36 (27-39)	short	absent	very short, muscular	0.14- (?)
	(W)	18 (17-19)				
Acetabulum	(L)	166 (151-184)	2½ x oral sucker	0.28 mm (diameter)	0.35-0.54 mm (diameter) mm	0.21-0.5 mm
	(W)	165 (151-178)				0.23-0.56 mm
Right testis	(L)	58 (48-68)	0.35 mm	0.14-0.15 mm	0.12-0.2 mm	0.09-0.24 mm
	(W)	61 (48-74)	0.4 mm	0.12-0.15 mm	0.12-0.18 mm	0.1 -0.3 mm
Left testis	(L)	68 (60-76)	0.35 mm	0.14-0.15 mm	0.12-0.2 mm	0.09-0.24 mm
	(W)	49 (25-72)	0.4 mm	0.12-0.15 mm	0.12-0.18 mm	0.1 -0.3 mm
Ovary	(L)	76 (60-91)	median, oval, post-testicular	0.08 mm	0.17-0.3 mm	0.06-0.23 mm
	(W)	86 (66-105)		0.12 mm	0.22-0.28 mm	0.1 -0.3 mm
Eggs	(L)	19	22	21-23	32-40	32-42
	(W)	10 numerous	10 numerous	9-12	16-23	20-23
Host:		*Acanthopagrus australis*	*Arripis trutta* (Salmon trout)	*Taractes (taractes) rubescens*	*Synodus dermatogenys*	*Trachinocephalus myops*
Site:		stomach	stomach, intestine	stomach	stomach	stomach
Locality		Red Rock Estuary, NSW	Port Phillip Bay, Victoria	Hawaii	Hawaii	Hawaii
Source:		This study	Woolcock, 1935	Yamaguti, 1970	Yamaguti, 1970	Yamaguti, 1970

PLATE 9: *Erilepturus acanthopagri* n. sp.

Whole mount, ventral view.

Scale length 0.1 mm.



Subfamily: ELYTROPHALLINAE Skrjabin and Guschanskaja, 1954

Genus : *Lecithocladium* Lühe, 1901

Lecithocladium sp.

Specimens deposited: W199708-199711.

Collection data:

- Number of worms measured : 4
- Site in host : stomach
- Locality : Arrawarra Headland (NSW)

Description:

Body elongate, with very short ecsoma, body length 1022 (754-1243); maximum width 228 (182-289) at posterior end of body. Tegumental plications prominent on anterior two-thirds of body. Oral sucker elongate, longer and larger than acetabulum, 225 (171-273) x 146 (114-174). Prepharynx and oesophagus lacking or indistinct. Pharynx very much elongated, anterior end slightly enlarged, extending from base of oral sucker to midlevel of acetabulum. Caeca bifurcate directly at junction between oral sucker and pharynx, ascending along sides of oral sucker before turning caudad, extend to posterior end of body proper, not reaching ecsoma. Acetabulum much smaller than oral sucker, and slightly shorter than pharynx, 144 (93-180) x 113 (62-140). Seminal vesicle saccular, its posterior end slightly postacetabular, continued anteriorly into tubular pars prostatica followed by long hermaphroditic duct. Genital pore at posteroventral margin of oral sucker. Testes two, unequal, obliquely tandem; anterior testis elliptical, 136 (114-149) x 51 (50-52); posterior testis bean-shaped, its posterior base contiguous with ovary, 146 (134-157) x 54 (45-62). Ovary transversely ovoid, 116 (93-138) x 61 (58-64). Vitellaria not observed, and covered by irregular-shaped uterus which extends from posterior level of ovary

to half-way between ovary and posterior end of body. Joining point between uterus and sinus sac not observed. Excretory arms extending far anteriorly, uniting dorsal to posterior region of oral sucker, excretory pore not observed. Eggs (?).

Remarks:

According to the key to species of *Lecithocladium* Lühe, 1901, given by Reid, Coil and Kuntz (1966), my specimens, which have an oral sucker larger than the acetabulum, a genital pore ventral to the posterior part of the oral sucker, and an ecsoma shorter than the soma, are similar to three species of *Lecithocladium*, i.e. *L. parviovum* Yamaguti, 1953; *L. scombri* Yamaguti, 1953; and *L. angustiovum* Yamaguti, 1953. However, my material is smaller than *L. parviovum*, which is almost six times larger than mine, Since none of my specimens was found fresh, and since in my permanent mounts of preserved material the important characters for determining the species (the arrangement of prostatic cells in *L. angustiovum* and the shape and size of the eggs in *L. scombri*) were not observed, my specimens cannot be included in either of Yamaguti's species. With regard to body size, my specimens are most similar to *L. scombri*.

The short ecsoma of my specimens is similar to that of *L. brevicaudum* found in the stomach of *Chrysophrys bifasciata* from India by Srivastava, 1942, but the latter species differs from my specimens not only in its larger body size, but also in the position of the genital pore which is at the postero-lateral margin of the oral sucker in my specimens and at the antero-ventral margin of the oral sucker in *L. brevicaudum*.

The prominent tegumental plications of my specimens are very much like those of *L. megalaspis* Yamaguti, 1953, but other characters are different. The plications may be due to the mode of fixation.

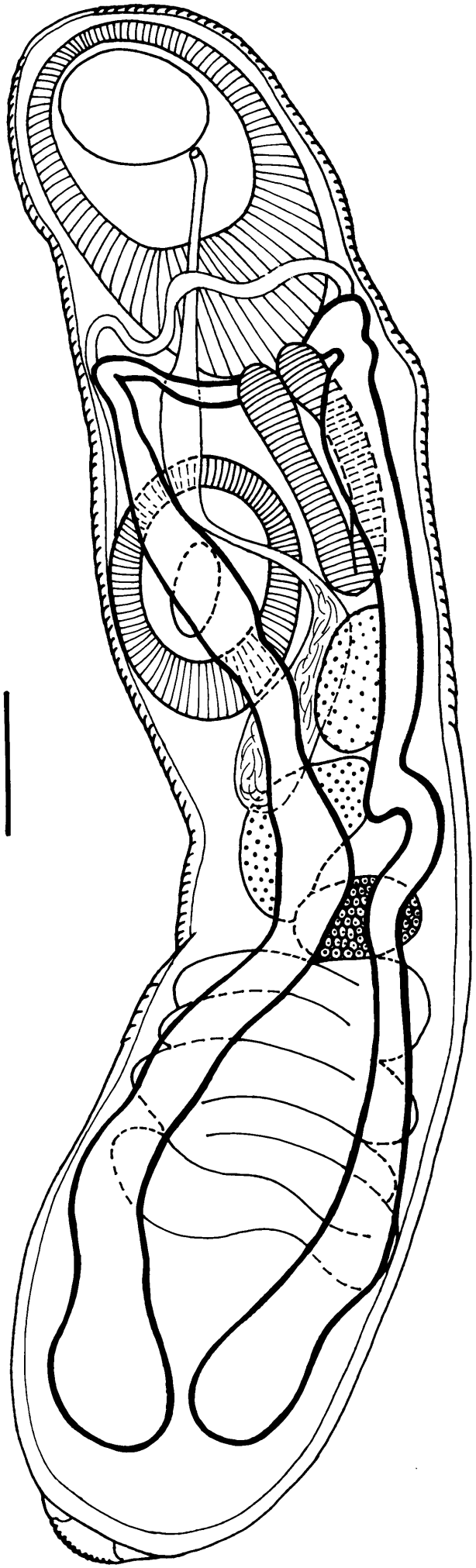
Table 4.10. Comparison of *Lecithocladium* sp. Lühe, 1901 from NSW and related species. Measurements are in micrometres unless otherwise indicated.

Character		*Lecithocladium* sp.	*L. brevicaudum* Srivastava, 1942 (mm)	*L. parviovum* Yamaguti, 1953
Body length		1022 (754-1243)	5.74	6.86 mm
Maximum width		228 (182-289)	1.02	0.68 mm
Cuticle		with plications at anterior two-thirds of the body	with tegumental scales or spines	-
Oral sucker	(L)	225 (171-273)	0.6	0.27 mm
	(W)	146 (114-174)	0.62	0.35 mm
Prepharynx		-	-	-
Pharynx	(L)	170 (128-192)	0.52	0.21 mm
	(W)	64 (58-70)	0.26	0.17 mm
Oesophagus		-	-	-
Acetabulum	(L)	144 (93-180)	0.48	0.225 mm
	(W)	113 (62-140)	0.62	0.27 mm
Anterior testis	(L)	136 (114-149)	(tandem, overlapping	**ovoid:**
	(W)	51 (50-52	each other	0.2-0.21 mm
			0.16-0.3-0.34)	x
Posterior testis	(L)	146 (134-157)	( )	0.16-0.175 mm
	(W)	54 (45-62)	( )	
Ovary	(L)	116 (93-138)	0.22	0.25 mm
	(W)	61 (58-64)	0.3	0.21 mm
Eggs	(L)	(?)	0.019	13-15
	(W)	(?)	0.011	9-10
Host:		*Acanthopagrus australis*	*Chrysophrys bifasciata*	*Scomber kanagurta*
Site:		stomach	stomach	stomach
Locality:		Arrawarra Headland, NSW	Pury, Bay of Bengal	Macassar
Source:		This study	Srivastava, 1942	Yamaguti, 1953

PLATE 10: *Lecithocladium* sp. Lühe, 1901

Whole mount, dorsal view.

Scale length 0.1 mm.



Subfamily: STERRHURINAE Looss, 1907 (Yamaguti, 1970)
Syn. LECITHOCHIRIINAE Lühe, 1901 (Gibson and Bray, 1979)

Genus : *Sterrhurus* Looss, 1907 (Yamaguti, 1970)

Syn. *Lecithochirium* Lühe, 1901 (Gibson and Bray, 1979)

Sterrhurus sp.

Specimens deposited: W199714-5.

Collection data:

- Number of worms measured : 3
- Site in host : stomach
- Locality : Yamba (NSW)

Description:

Body plump, slightly elongate, tegument smooth and thin, no tegumental plications, total length 736 (711-761); maximum width 307 (298-314). Oral sucker subterminal, 74 (66-85) x 87 (83-95). Prepharynx inconspicuous or lacking. Pharynx well developed, 47 (45-48) x 44 (43-45). Oesophagus absent or indistinct. Acetabulum rounded, much larger than oral sucker, in anterior two-thirds of body or at posterior part of anterior third of body, 159 (153-165) x 175 (169-186). Testes two, postacetabular, symmetrical, well apart from each other; right testis elliptical, 46 (41-52); left testis tear-shaped, almost contiguous with ovary, 44 (41-45) x 110 (87-124). Ovary transversely elongated, bean-shaped, posterior to left testis, 56 (45-72) x 119 (93-140). Vitellaria consist of six globular masses, immediately postovarian. Eggs small, numerous, 19 x 12. Uterine coil extending from posterior end of acetabulum to base of vitellaria. Seminal vesicle situated behind acetabulum; genital pore just to left of pharynx. Caeca terminating blindly at posterior end of body proper not entering ecsoma. Excretory vesicle not observed.

Remarks:

My specimens of *Sterrhurus* are most like *S. gymnothoracis* Yamaguti, 1941, found in the stomach of *Gymnothorax kidako* in Japan. They differ, however, in all body dimensions which are much smaller than in *S. gymnothoracis*, except for the egg size, and in the position of the genital pore which is ventral to the pharynx in Yamaguti's specimens, and to the left of the pharynx in mine.

Whereas my specimens have vitellaria consisting of 6 globular masses, Yamaguti's specimens have vitellaria consisting of seven digitiform lobes, four on the right and three on the left.

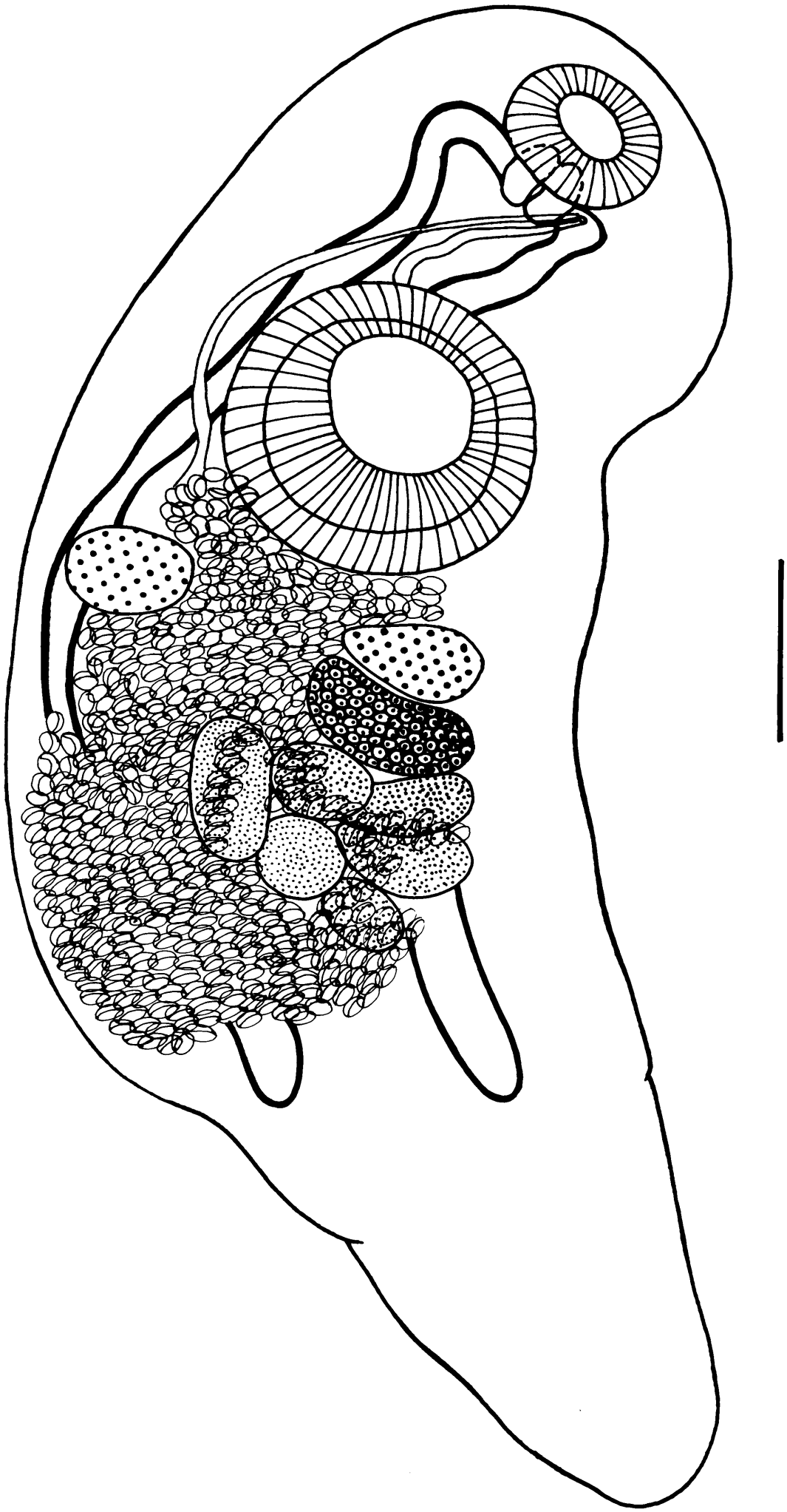
Table 4.11 Morphological comparison between *Sterrhurus* sp. Looss 1907 (Yamaguti, 1970) from NSW and related species. Measurements are in micrometres unless otherwise indicated.

Character		*Sterrhurus* sp.	*S. gymnothoracis* Yamaguti, 1941	*S. congeri* (Manter and Pritchard, 1960) n. comb.	*S. nagrosomi* Yamaguti, 1940
Body length		736 (711-761)	2.6-4.8 mm	2.0-3.4 mm	2.4-4.4 mm
Maximum width		307 (298-314)	1.0-1.3 mm	0.65-1.3 mm	0.6-0.7 mm
Oral sucker	(L)	74 (66-85)	0.2-0.31 mm	0.24-0.4 mm	0.13-0.19 mm
	(W)	87 (83-95)	0.2-0.35 mm	0.18-0.41 mm	0.18-0.2 mm
Prepharynx		-	-	-	-
Pharynx	(L)	47 (45-48)	0.09-0.15 mm	0.08-0.19 mm	0.09-0.11 mm
	(W)	44 (43-45)	0.1-0.18 mm	0.07-0.17 mm	(diameter)
Oesophagus		indistinct	very short	short	very short
Acetabulum	(L)	159 (153-165)	0.32-0.56 mm	0.42-0.65 mm	0.4-0.44 mm
	(W)	175 (169-186)	0.36-0.6 mm	0.46-0.73 mm	(diameter)
Right testis	(L)	46 (41-52)	0.24-0.36 mm	0.08-0.25 mm) subglobular,	0.2-0.25 mm)
	(W)	80 (68-103)	0.18-0.28 mm	0.13-0.27 mm) subsymmetrical,	0.18-0.2 mm) subglobular,
Left testis	(L)	44 (41-45)	0.24-0.36 mm	0.08-0.25 mm) posterolateral to acetabulum	0.2-0.25 mm) symmetrical
	(W)	110 (87-124)	0.18-0.28 mm	0.18-0.27 mm	0.18-0.2 mm
Ovary	(L)	56 (45-72)	0.18-0.25 mm	0.18-0.17 mm	0.15-0.26 mm
	(W)	119 (93-140)	0.24-0.36 mm	0.18-0.32 mm	(transversely elongated oval)
Eggs	(L)	19	18-21	16-23	21-24
	(W)	12	12	8-11	15-17
Vitellaria		6 globular masses	7 digitiform lobes (4 right, 3 left)	7 digitiform lobes (4 and 3 groups)	7 short digitiform lobes
Host:		*Acanthopagrus australis*	*Gymnothorax kidako*	*Conger marginatus*	*Pagrosomus unicolor*
Site:		stomach	stomach	stomach	stomach
Locality		Yamba, NSW	Hamazima, Mie Prefecture, Japan	Maui, Hawaii	Inland Sea, Japan
Source:		This study	Yamaguti, 1941	Yamaguti, 1970	Yamaguti, 1940

PLATE 11: *Sterrhurus* sp. Looss, 1907 (Yamaguti, 1970)

Whole mount, ventral view.

Scale length 0.1 mm.



Family : DEROGENIDAE Nicoll, 1910

Subfamily : DEROGENINAE Nicoll, 1910

Genus : *Derogenoides* Nicoll, 1913

Derogenoides sp.

Specimen deposited: W199719.

Collection data:

- Number of worms measured: 1
- Site in host : stomach
- Locality : Arrawarra Lagoon (NSW)

Description:

Body length 488; maximum width 144 at level of acetabulum; tegument very slightly annulated. Oral sucker subterminal 76 x 70. Prepharynx absent. Pharynx contiguous with oral sucker, 31 x 35. Oesophagus not observed, or perhaps very short. Acetabulum 128 x 103, globular. Testes obliquely tandem; anterior (right) testis 43 x 66 tear-shaped, postacetabular, almost contiguous with posterior (left) testis. Posterior testis 48 x 56. Ovary posttesticular, contiguous with posterior (left) testis, 52 x 54. Seminal receptacle just in front of ovary at posterior end of left testis. Intestinal diverticula simple, reaching almost to posterior end of body. Excretory vesicle not observed. Seminal vesicle small, globular. Pseudocirrus pouch globular. Genital pore immediately ventral to intestinal bifurcation. Eggs few in number, relatively large, operculate, 29 (27-31) x 12 (8-19).

Remarks:

The genus *Derogenoides* was first erected by Nicoll, 1913 for *D. ovacutus* found in *Trachinus draco*, Plymouth - USA. All important characters of my specimen agree with those of *D. ovacutus* as described by Nicoll, 1913 in his original description. However, my species is

shorter and narrower than *D. ovacutus*. It also differs from *D. ovacutus* in having obliquely tandem non-symmetrical testes, compared with approximately symmetrical testes in *D. ovacutus*. The size of the testes is larger in *D. ovacutus* than in mine, and the eggs of Nicoll's specimens differ both in shape and size. Whereas Nicoll's specimens have an opercular pole drawn out into a sharp point, my specimen does not have a pointed egg, and the eggs of my specimen are smaller than in Nicoll's species.

Although my specimen may belong to a new species, establishment of a new species is postponed until more material is available.

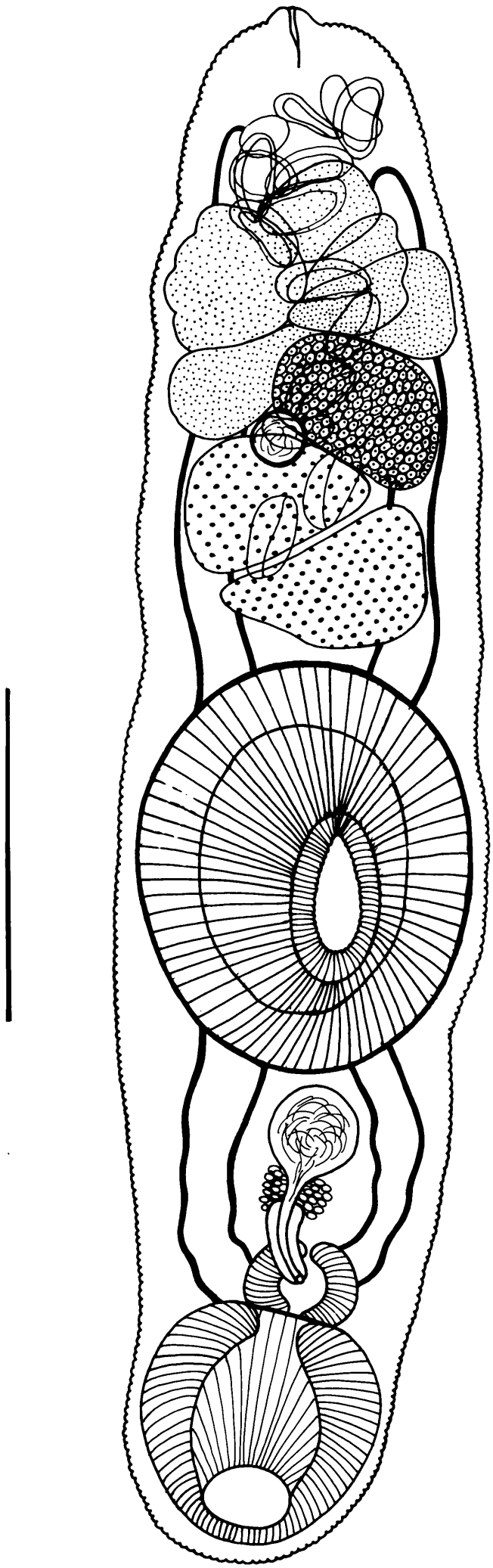
Table 4.12. Morphological comparison between *Derogenoides* sp. and *D. ovacutus* Nicoll, 1913.
Measurements are in micrometres unless otherwise indicated.

Character		*Derogenoides* sp.	*D. ovacutus* Nicoll, 1913
Body length		488	0.6-0.9 mm
Maximum width		144	0.18 mm
Oral sucker	(L)	76	0.066 mm
	(W)	70	(diameter)
Prepharynx		absent	absent
Pharynx	(L)	31	-
	(W)	35	-
Oesophagus		not observed	very short
Acetabulum	(L)	128	0.123 mm
	(W)	103	(diameter)
Anterior/Right testis	(L)	43	(approximately
	(W)	66	(symmetrical
Posterior/Left testis	(L)	48	(0.12 x 0.096 mm
	(W)	56	(
Ovary	(L)	52	0.07 mm
	(W)	54	0.12 mm
Eggs	(L)	29 (27-31)	0.038 (0.033-0.042) mm
	(W)	12 (8-19)	0.018 (0.015-0.019) mm
Host:		*Acanthopagrus australis*	*Trachinus draco*
Site:		stomach	-
Locality		Arrawarra Headland, NSW	Plymouth, USA
Source:		This study	Nicoll, 1913

PLATE 12: *Derogenoides* sp.

Whole mount, ventral view.

Scale length 0.1 mm.



Class : CESTODA

Subclass : EUCESTODA Southwell, 1930

Order : NIPPOTAENIA Yamaguti, 1939

Family : NIPPOTAENIIDAE Yamaguti, 1939

Genus : *Nippotaenia* Yamaguti, 1939

Nippotaenia sp. (larva)

Specimen deposited: W199694.

Collection data:

- Number of worms measured: 1
- Site in host : pyloric caeca
- Locality : Red Rock Estuary (NSW)

Description:

Small tapeworm with total length from tip of apical sucker to posterior end of body 1740. Body width at shoulder region 347, maximum width 430. Unsegmented. Anterior end is not set off as a scolex but bears a single apical sucker (acetabulum), 145 x 128.

Remarks:

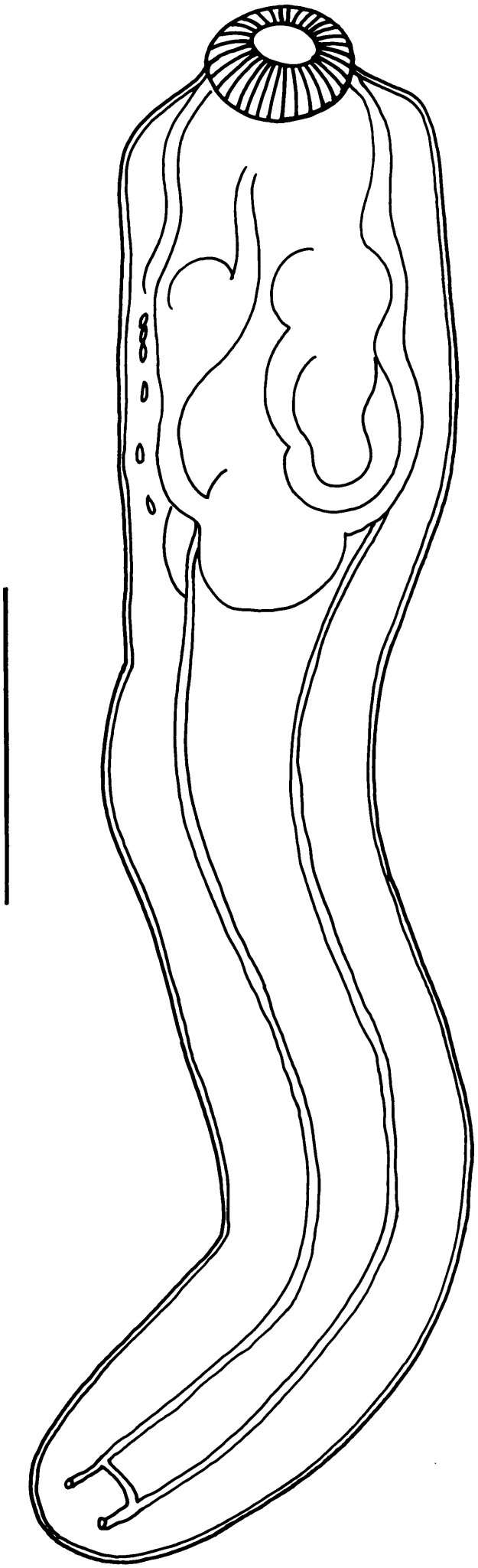
My specimen of *Nippotaenia* is characterized by the possession of a well developed apical sucker, which is the important character of the Nippotaeniidae (see Yamaguti, 1939a). His first species of the genus *Nippotaenia* described was *N. chaenogobii* (Yamaguti, 1939) found in the small intestine of *Chaenogobius annularis urotaenia, Gobius similis,* and *Mogurnda obscura* in Japan.

My specimen differs from Yamaguti's in its body dimensions and in the absence of minute spines.

A specimen of this cestode group is recorded for the first time in the black bream.

PLATE 13: *Nippotaenia* sp. Yamaguti, 1939 (larva)

Whole larva; scale length 0.3 mm.



Order : TRYPANORHYNCHA Diesing, 1863

Suborder : CYSTIDEA Guiard, 1927

Family : GYMNORHYNCHIDAE Dollfus, 1935

Genus : *Gymnorhynchus* Rudolphi, 1819

Gymnorhynchus sp. Rudolphi (1819) Larva,

Type 1, Form 1

Specimen deposited: Not yet available.

Collection data:

- number of worms measured: 1
- Site in host : pyloric caeca
- Locality : Red Rock Estuary (NSW)

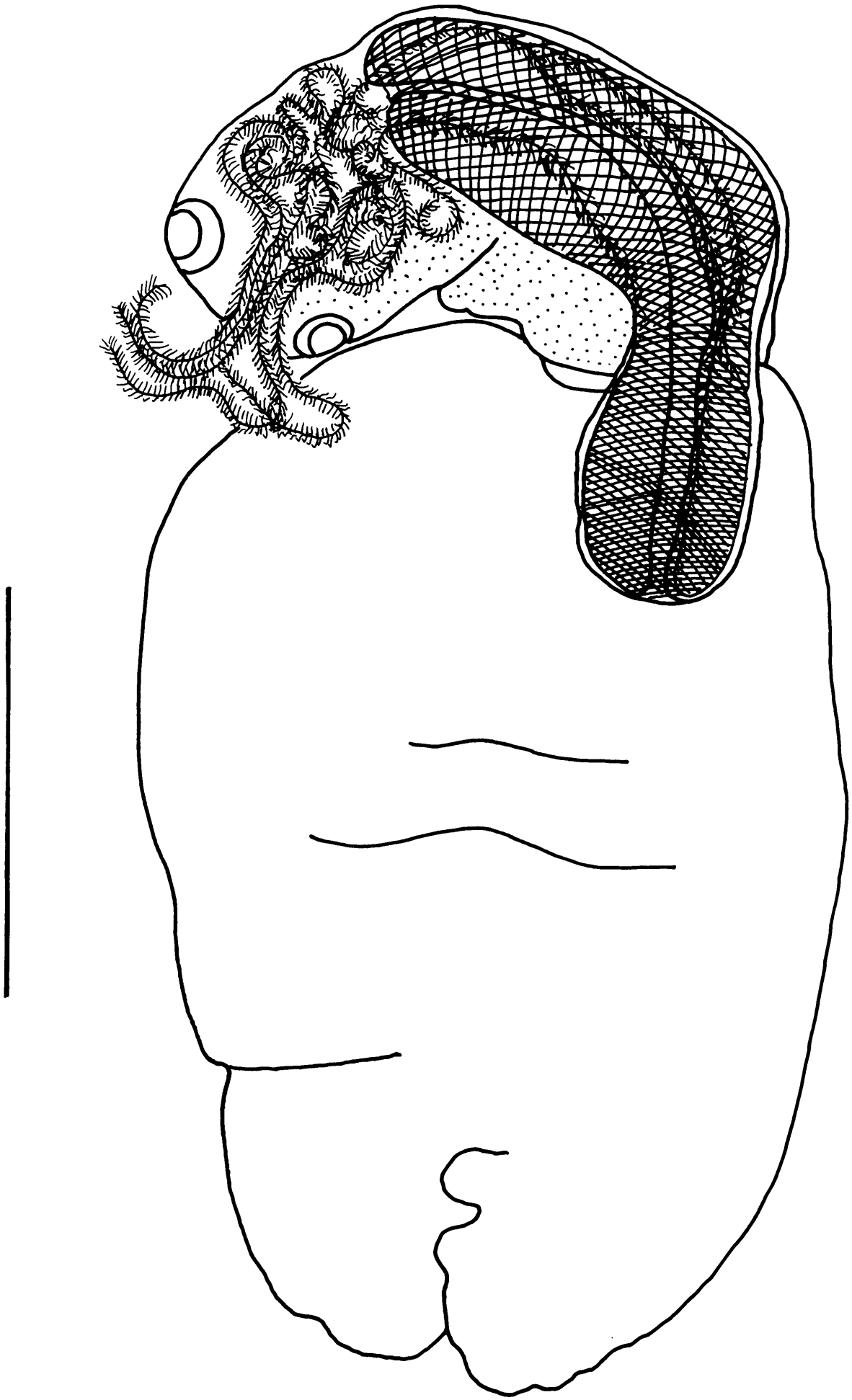
Description:

Small tapeworm, with egg-shaped body, and with protuded scolex, 808 long and 521 wide. Two-thirds of bulbs protruded, followed by irregular, coiled spiny probocides which are partially everted. Length of scolex region 455, and width 231. Proboscis bulb 579 x 70.

Remarks:

My specimen is very much like *Gymnorhynchus malleus* (Linton, 1924) described by Chandler (1935) from the mesenteries of *Galeichthys felis* in Galveston Bay, except that my specimen is much smaller than Chandler's specimens which are about 4 to 5 mm in length and 2.5 mm in breadth.

PLATE 14: *Gymnorhynchus* sp. Rudolphi (1819) Larva,
Type 1, Form 1.
Whole larva; scale length 0.3 mm.



Genus: *Gymnorhynchus* Rudolphi, 1819

Gymnorhynchus sp. Rudolphi (1819) Larva, Type 1, Form 2

Specimens deposited: Not yet available.

Collection data:

- Number of worms measured: 6
- Site in host : pyloric caeca and posterior intestine
- Locality : Red Rock Estuary (NSW)

Description:

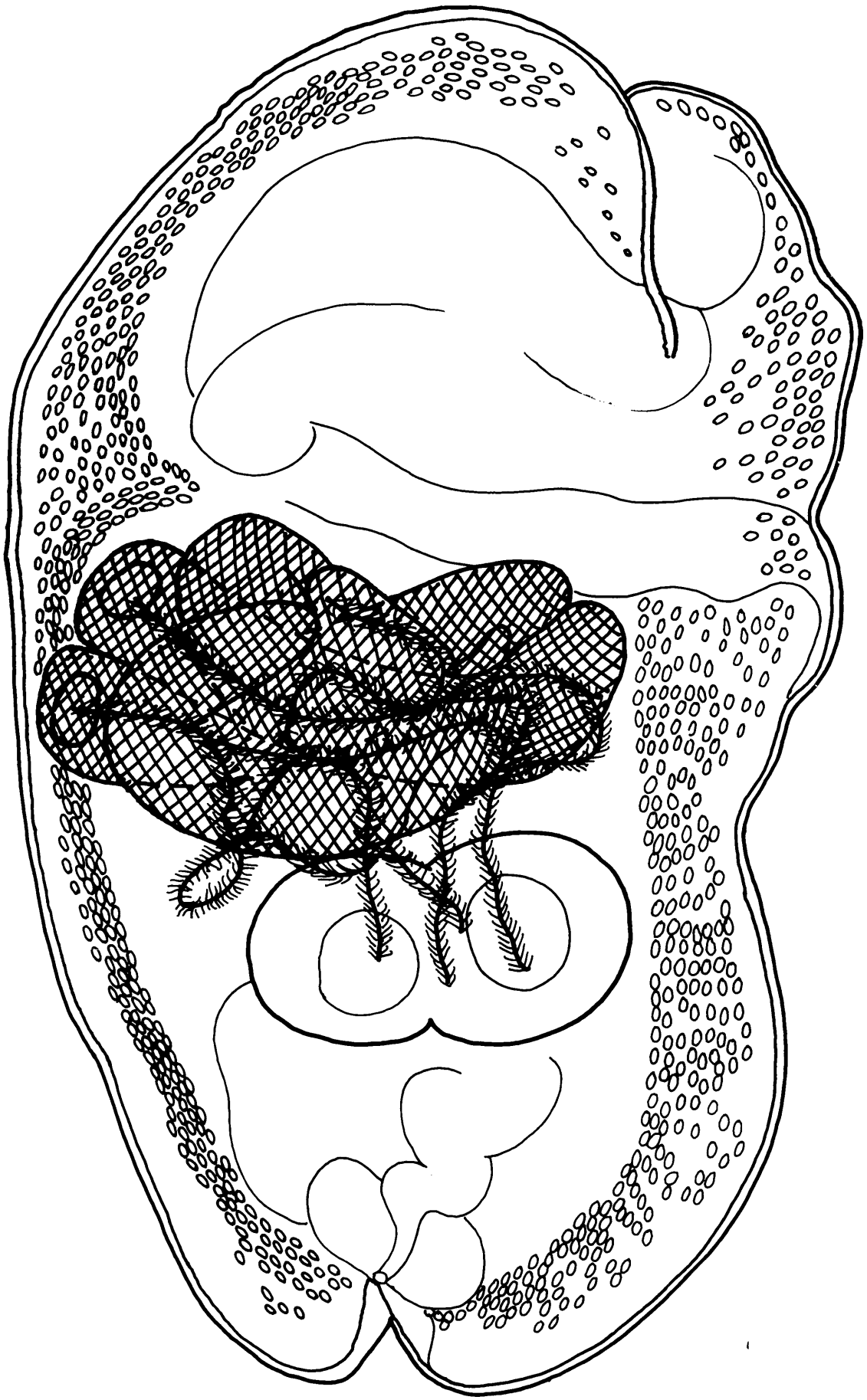
Small, 1098 (994-1243) long, and 652 (570-725) wide, with proboscis bulbs and spiny probocides all inverted into body. Proboscis bulb 408 (372-446) x 81 (72-91). Granules (calcareous bodies) vary from elongate oval to almost circular, 16 (12-19) x 9 (6-12).

Remarks:

The specimens of *Gymnorhynchus* sp. Rudolphi (1819) Larva, Type 1, Form 2 have characteristics similar to those of *Gymnorhynchus* sp., Larva, Type 1 Form 1, except that all my specimens have proboscis bulbs, spiny probocides, scolex and neck inverted into the egg-shaped body. These larvae have larger body dimensions than those of Type 1, Form 1. They also differ in having longer proboscis bulbs and in the presence of calcareous bodies.

PLATE 15: *Gymnorhynchus* sp. Rudolphi (1819) Larva, Type 1, Form 2.

Whole larva; scale length 0.3 mm.



Genus: *Gymnorhynchus* Rudolphi, 1819

Gymnorhynchus sp. Rudolphi (1819) Larva, Type 2

Specimen deposited: W199702.

Collection data:

- Number of worms measured: 1
- Site in host : debris
- Locality : Red Rock Estuary (NSW)

Description:

Small form, 1222 long by 405 wide, body narrower in anterior region. Proboscis bulbs 476 x 97, and spiny probocides inverted into body. Granules (calcareous bodies) 39 x 19.

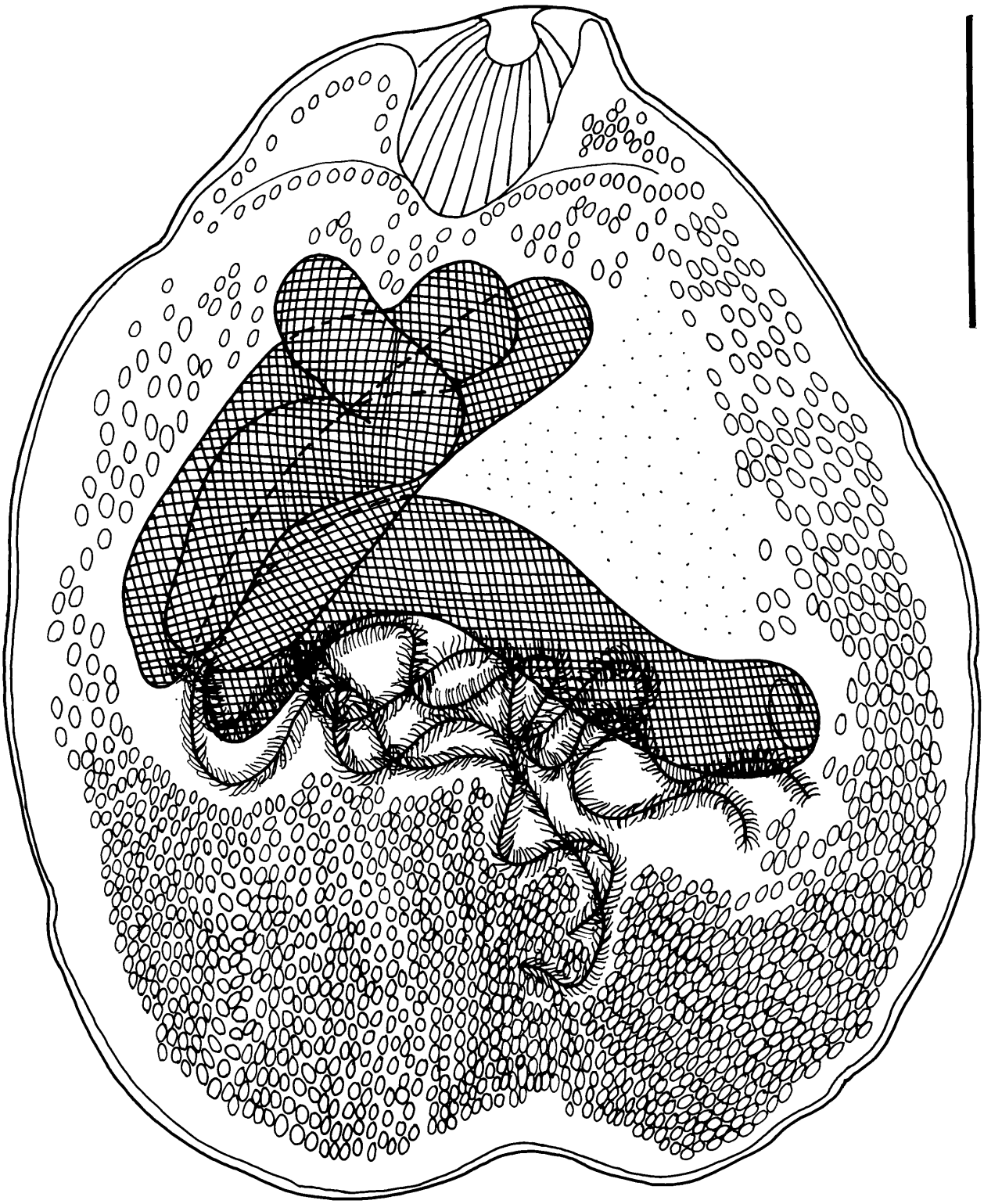
Remarks:

The specimen of *Gymnorhynchus* sp. Rudolphi, (1819) pleurocercoid/ larva Type 2 is very much like both *Gymnorhynchus* sp. Type 1, Form 1 and Form 2. It differs, however, from Type 1 Form 1 and Form 2 in having a longer body. The body width falls between Type 1 Form 1 and Type 1 Form 2. The proboscis bulb is longer than that of Type 1 Form 1 and Form 2.

The prominent differences are the size of the granules, which are 39 x 19 compared with 10 x 4 in Type 1 Form 1 and 16 (12-19) x 9 (6-12) in Type 1 Form 2; and the shape and length of the spiny probocides which are slightly longer than in Type 1 Form 1 and Form 2.

PLATE 16: *Gymnorhynchus* sp. Rudolphi (1819)Larva, Type 2.

Whole larva; scale length 0.3 mm.



Order : PROTEOCEPHALIDEA Mola, 1928

Family : PROTEOCEPHALIDAE LaRue, 1911

Subfamily : PROTEOCEPHALINAE Mola, 1929

Genus : *Proteocephalus* Weinland, 1858

Proteocephalus sp. Weinland, 1858 (Larvae)

Specimens deposited: W199698.

Collection data:

- Number of worms measured: 5
- Site in host : pyloric caeca
- Locality : Red Rock Estuary (NSW)

Description:

Body elongate, no visible segmentation, with anterior scolex. Body 1372 (956-1699) long and 385 (347-422) wide. Apical sucker 103 (81-151) x 137 (114-207). Other suckers 172 (120-207) x 131 (89-161). Calcareous bodies (granules) not clearly observed. No proglottids.

Remarks:

My specimens closely resemble *Proteocephalus australis* Chandler, 1935, described by Chandler (1935) from the intestine of *Lepisosteus osseus* in Galveston Bay, Texas, especially in the scolex, although body dimensions are different.

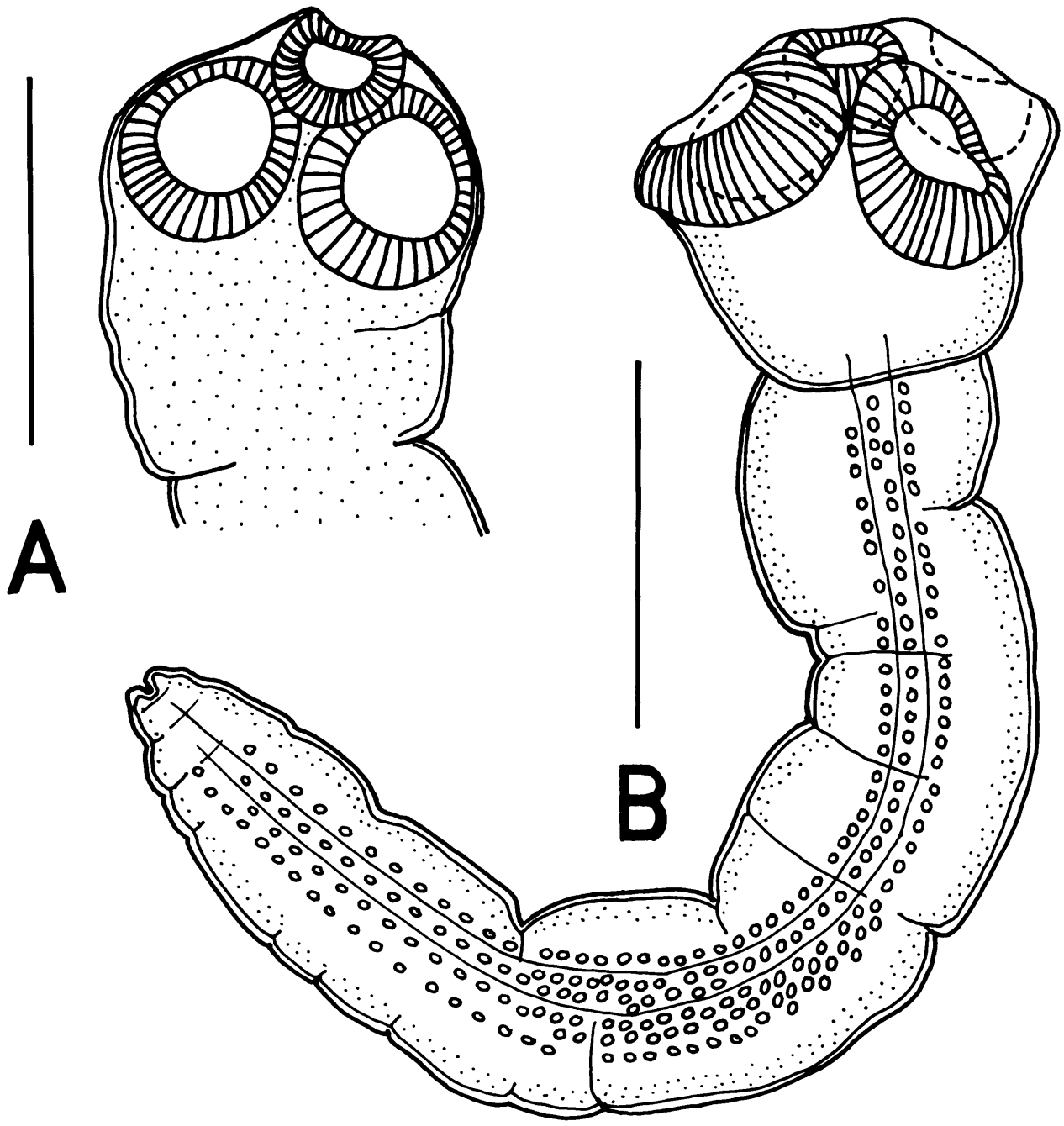
Characters are insufficient for a species diagnosis.

PLATE 17: *Proteocephalus* sp. Weinland, 1858 (Larva)

A. Scolex

B. Whole larva

Scale length 0.3 mm.


A
B

Phylum : ASCHELMINTHES

Class : NEMATODA

Subclass : SECERNENTEA

Order : ASCARIDIDA Yamaguti, 1961

Superfamily : ASCARIDOIDEA Chabaud, 1965

Family : ANISAKIDAE (Railliet and Henry, 1912, subfamily) Skrjabin and Karokhin, 1945 (= Heterocheilidae Railliet and Henry, 1915, in part; = Stomachidae (Johnston and Mawson, 1945, subfamily) Hartwich, 1957)

Subfamily : ANISAKINAE Railliet and Henry, 1912 (= Capsulariinae Johnston and Mawson, 1943; = Filocapsulariinae Yamaguti, 1961, in part; = Stomachinae Johnston and Mawson, 1945)

Genus : *Terranova* Leiper and Atkinson, 1914
(= *Metangusticaecum* Mozgovoi, 1951;?
= *Paracanthocheilus* Kreis, 1952;
= *Terranova* (*Sauronema*) Mozgovoi, 1951)
Terranova sp., Type 1, Larva, Cannon, 1977 p. 235, Fig. 2A.

Specimens deposited: W199701.

Collection data:

- Number of worms measured: 2
- Site in host : intestine
- Locality : Red Rock Estuary (NSW)

Description:

6.6 (6.4-6.8) mm long, 216 (200-231) wide, transverse striation prominent in head and tail regions, lips inconspicuous, but conspicuous boring tooth at anterior end; four small papillae; excretory pore just posterior to level of nerve ring. Nerve ring 269 (207-331) from anterior

end. Oesophagus 880 (827-932), followed by ventriculus 900 (661-1139) and dorsal intestinal caecum 1003 (761-1243). Anus 140 (124-155) from posterior end. Body width at level of anus 81 (78-83).

Remarks:

These specimens agree in all important characters with *Terranova*, Type 1 larva described by Cannon, 1977. However, the measurements are slightly different, possibly due to the fact that I had only two formalin-fixed specimens, whereas Cannon examined worms recovered from chilled fish and fixed in hot 70% alcohol.

Table 4.13. Comparison between present specimens and Cannon's specimens of *Terranova*, Type 1, Larva. All measurements are in micrometers unless otherwise indicated.

Character	Present specimen	Cannon, (1977) (mm)
Body length	6631 (6449-6813)	9.26 ± 1.6 (range 5.80-12.75)
Maximum width	216 (200-231)	0.178 ± 0.043 (range 0.111-0.300)
Anterior end to nerve ring	269 (207-331)	0.232 ± 0.050) (range 0.125-0.350)
Oesophagus	880 (827-932)	0.995 ± 0.186 (range 0.725-1.400)
Ventriculus	900 (661-1139)	0.943 ± 0.253 (range 0.558-1.450)
Intestinal caecum	1002 (761-1243)	1.019 ± 0.264 (range 0.625-1.488)
Tail	140 (124-155)	0.138 ± 0.029 (range 0.100-0.204)
Body width at level of anus	81 (78-83)	0.090 ± 0.018 (range 0.055-0.125)
Host:	*Acanthopagrus australis*	*Apogonichthys poecilopterus* (Apogonidae); *Plectropomus maculatus* (Serranidae); *Euthynnus alleteratus*, *Kishinoella tonggol*, *Scomberomorus commerson* (Scombridae); *Pranesus ogilbyi* (Atherinidae)
Site in host:	intestine	Connective tissue and mesenteries of viscera
Locality:	Red Rock Estuary, NSW	South-eastern Queensland
Source:	This study	Cannon, 1977

PLATE 18: *Terranova* sp. Type 1, Larva, Cannon, 1977

A. Anterior one-third of body, lateral view.

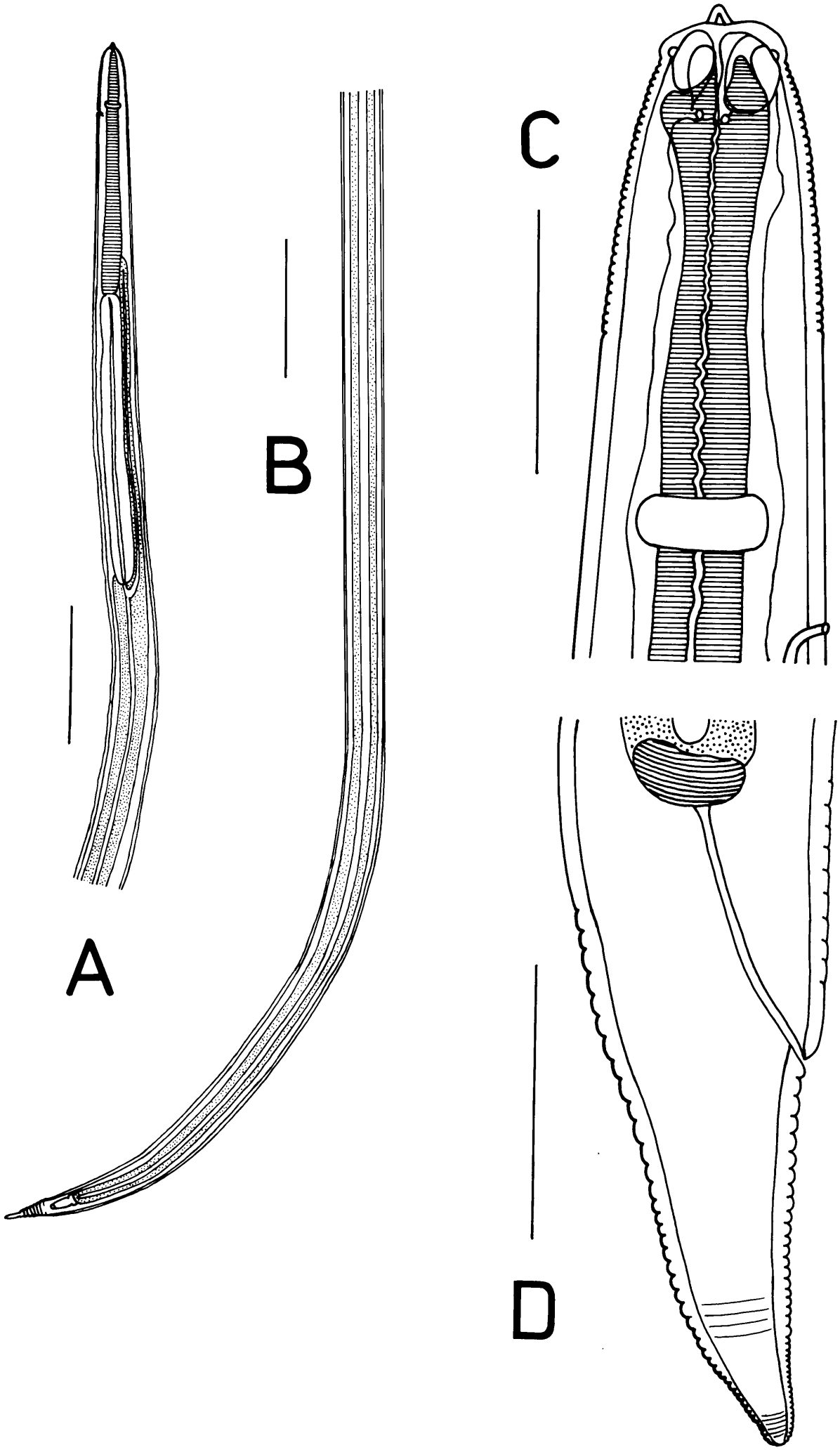
B. Posterior two-thirds of body, ventro-lateral view.

C. Anterior end, lateral view.

D. Posterior end, lateral view.

Scale length: A, B - 0.5 mm

C, D - 0.1 mm


A
B
C
D

Genus: *Terranova* Leiper and Atkinson, 1914

Terranova sp. Type 2, Larva, Cannon, 1977 p. 235, fig. 2B

Specimen deposited: W199695.

Collection data:

- Number of worms measured: 1
- Site in host : mesentaries around the pyloric caeca and rectum
- Locality : Red Rock Estuary (NSW)

Description:

Almost same size as Type 1, 6.8 mm long, 278 wide, body striated only in tail region. Other characters similar to Type 1 except size of ventriculus and intestinal caecum. Ventriculus short, 314 long, more than half as long as intestinal caecum, 496 long. Nerve ring 256, tip of caecum 628 and excretory pore 314 from anterior end of body. Length of oesophagus 785, and tail 91. Body width at level of anus 91.

Remarks:

This specimen agrees in most respects with *Terranova* Type 2, Larva, Cannon, 1977, p. 235, fig. 2B. The only difference is that the length of the ventriculus is more than half the length of the intestinal caecum. The measurements of my specimen fall in the range of Cannon's.

Table 4.14. Comparison between the present specimen and Cannon's specimen of *Terranova*, Type 2, Larva.

All measurements are in micrometers unless otherwise indicated.

Character	Present specimen	Cannon (1977) (mm)
Body length (mm)	6.8	7.24 ± 1.04 (range 4.25-9.87)
Maximum width	273	0.154 ± 0.029 (range 0.075-0.250)
Anterior end to nerve ring	256	0.243 ± 0.028 (range 0.175-0.325)
Anterior tip of caecum	628	0.540 ± 0.081 (range 0.353-0.800)
Length of muscular oesophagus	785	0.853 ± 0.096 (range 0.625-1.125)
Length of ventriculus	314	0.315 ± 0.046 (range 0.200-0.500)
Intestinal caecum	496	0.625 ± 0.089 (range 0.400-0.925)
Tail	91	0.110 ± 0.047 (range 0.074-0.186)
Body width at level of anus	91	0.076 ± 0.014 (range 0.025-0.111)

Host:	*Acanthopagrus australis*	*Carcharinus nasuta*, *Eulamia spallanzani* *Scoliodon jordani* (GALEIDAE) and others
Site in host:	mesenteries around the pyloric caeca and rectum	viscera
Locality:	Red Rock Estuary, NSW	South-eastern Queensland
Source:	This study	Cannon, 1977

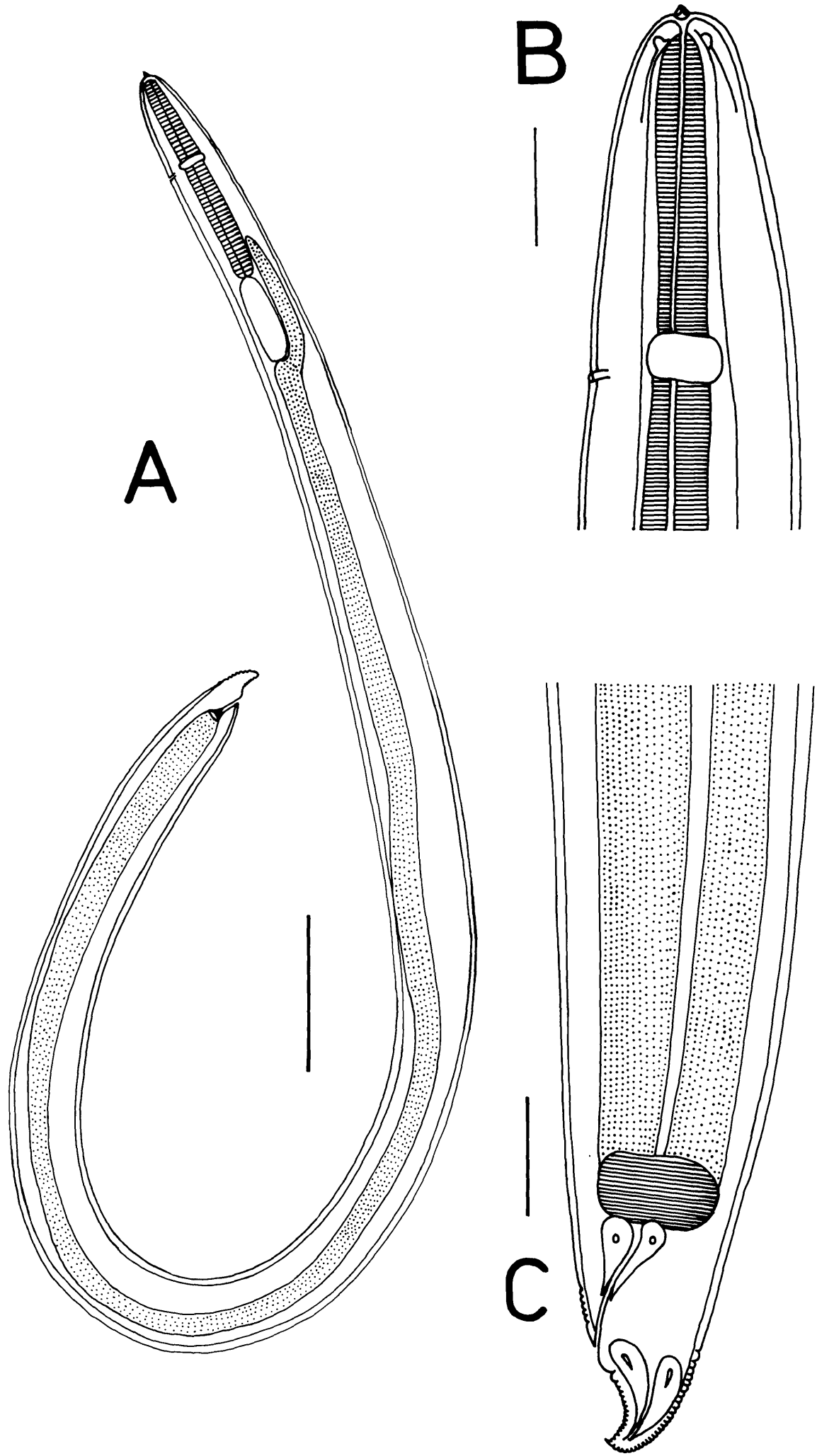
PLATE 19: *Terranova* sp., Type 2, Larva, Cannon, 1977

A. Whole mount, lateral view.

B. Anterior end, lateral view.

C. Posterior end, lateral view.

Scale length A - 0.5 mm, B, C - 0.1 mm


A
B
C

Genus: *Contracaecum* Railliet and Henry, 1912

(= *Amphicaecum* Walton, 1927;

= *Cerascaris* Cobb, 1929;

= *Contracaecum* (*Ornitocaecum*) Mozgovoi, 1951;

= *Contracaecum* (*Synthetonema*) Kreis, 1952;

= *Kathleena* Leiper and Atkinson, 1914)

Contracaecum sp. (Larva)

Specimen deposited: W199704.

Collection data:

- number of worms measured: 1
- Site in host : stomach
- Locality : Yamba (NSW)

Description:

16 mm long, 932 wide, anterior tip of body conical, cuticle strongly annulated. Lips inconspicuous, boring tooth distinct at anterior extremity, 41 long, head papillae and excretory pore not observed. Nerve ring 190 from anterior end. Oesophagus 3391 x 83. Two appendices joined in mid-line, 'right' ventricular appendix 761 x 116, 'left' ventricular appendix 703 x 124. Intestinal caecum 3101. Posterior part of body heavily contracted and annulated, so that anus not observed.

Remarks:

In general, and more specifically in the anterior part of the body, my specimen agrees with *Contracaecum* sp., Type 1, Larva, Cannon, 1977, fig. 3A(a), especially in having a similar intestinal caecum almost as long as the oesophagus. However, my specimen has two ventricular appendices forming a right and left ventricular appendix which seem to be similar to that in *Thynnascaris*, Type 1, Larva, Cannon, 1977 p. 240. The size of the present larva is much larger than *Contracaecum* sp., Type 1, Larva, Cannon, 1977.

Table 4.15. Comparison between the present specimen and Cannon's specimen of *Contracaecum*, Type 1, Larva.

All measurements are in micrometers unless otherwise indicated.

Character	Present specimen	Cannon (1977) (mm)
Body length (mm)	16	21.24 ± 2.94 (range 19.00-26.75)
Maximum width	932	0.888 ± 0.143 (range 0.675-1.000)
Boring tooth	41	-
Nerve ring from anterior end	190	0.277 ± 0.039 (range 0.250-0.0325)
Oesophagus length	3391	2.662 ± 0.083 (range 2.540-2.750)
Ventriculus	*)	0.168 ± 0.038 (range 0.125-0.225)
Ventricular appendix -'right part'	761x116	0.648 ± 0.084 (range 0.540-0.750)
'left part'	703x124	
Intestinal caecum	3101	2.128 ± 0.158 (range 1.971-2.375)
Host:	*Acanthopagrus australis*	*Mugil cephalus; M. dussumieri; M. strongylocephalus* (MUGILIDAE)
Site in host:	stomach	kidney and liver
Locality	Yamba, NSW	South-eastern Queensland
Source:	This study	Cannon, 1977

*) inconspicuous

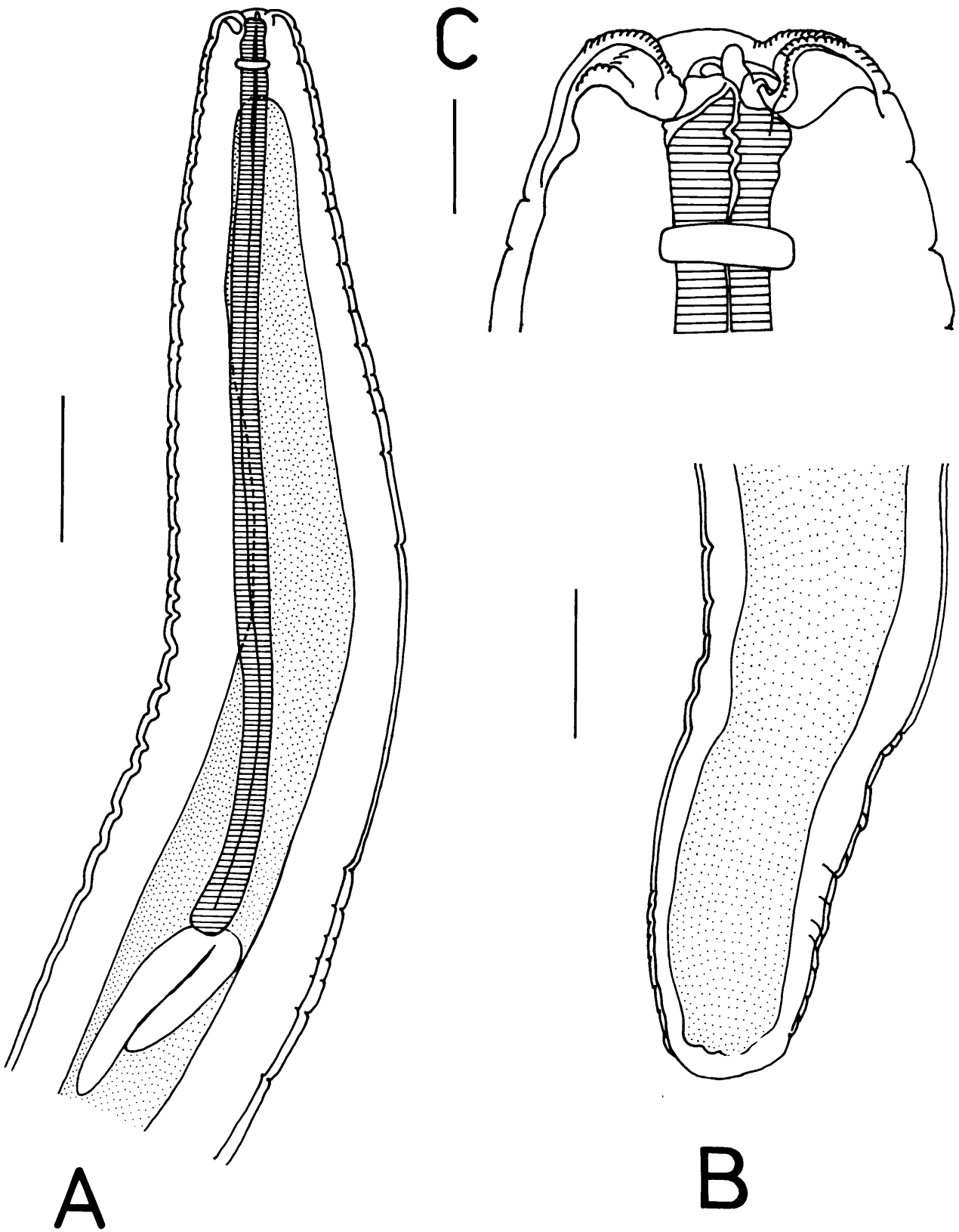
PLATE 20: *Contracaecum* sp. (Larva)

A. Anterior end, laveral view.

B. Posterior end, lateral view.

C. Head, lateral view.

Scale length A, B - 0.5 mm, C - 0.1 mm.


C
A
B

Subfamily: RAPHIDASCARIDINAE Hartwich, 1954

Genus : *Hysterothylacium* Ward and Magath, 1917 (see Deardorff and Overstreet, 1981)

syn. *Thynnascaris* Dollfus, 1933

(= *Contracaecum* (*Thynnascaris*) Dollfus, 1935;

= *Contracaecum* (*Erschowicaecum*) Mozgovoi, 1951;

= *Contracaecum* (*Symplexonema*) Kreis, 1952 nom. nud.;

= *Iheringascaris* Pereira, 1935)

Hysterothylacium sp.

syn. *Thynnascaris* sp., Type 1, Larva, Cannon, 1977, p. 237, fig. 4A.

Specimen deposited: W199699.

Collection data:

- Number of worms measured: 1
- Site in host : debris
- Locality : Red Rock Estuary (NSW)

Description:

2491 long, 196 wide, with cuticule striations in all parts of body, especially in head and tail regions. Lips inconspicuous, but three muscular bands between end of oesophagus and anterior end of body. Distances from anterior end to nerve ring 114, to excretory pore 186 and to tip of caecum 215. Length of muscular oesophagus 413; intestinal caecum 207; ventriculus 62; ventricular appendix 355. Anus 83 from tip of tail. Body width at level of anus 52.

Remarks:

This specimen is similar to those described by Mawson (1957) in its small ventriculus, long appendix, short intestinal caecum, conical tail with short digitiform tip, and the lack of spines; and to those

described by Cannon (1977) in the inconspicuous lips and boring tooth, and the position of the excretory pore. Since there are no measurements given by Mawson (1956), no comparison can be made with his specimens. However, the measurements of my specimen are within the range of the measurements given by Cannon (1977).

Table 4.16. Comparison between the present specimen and Cannon's specimen of *Hysterothylacium* Ward and Magath, 1917 syn. *Thynnascaris*, Type 1, Larva. All measurements are in micrometers unless otherwise indicated.

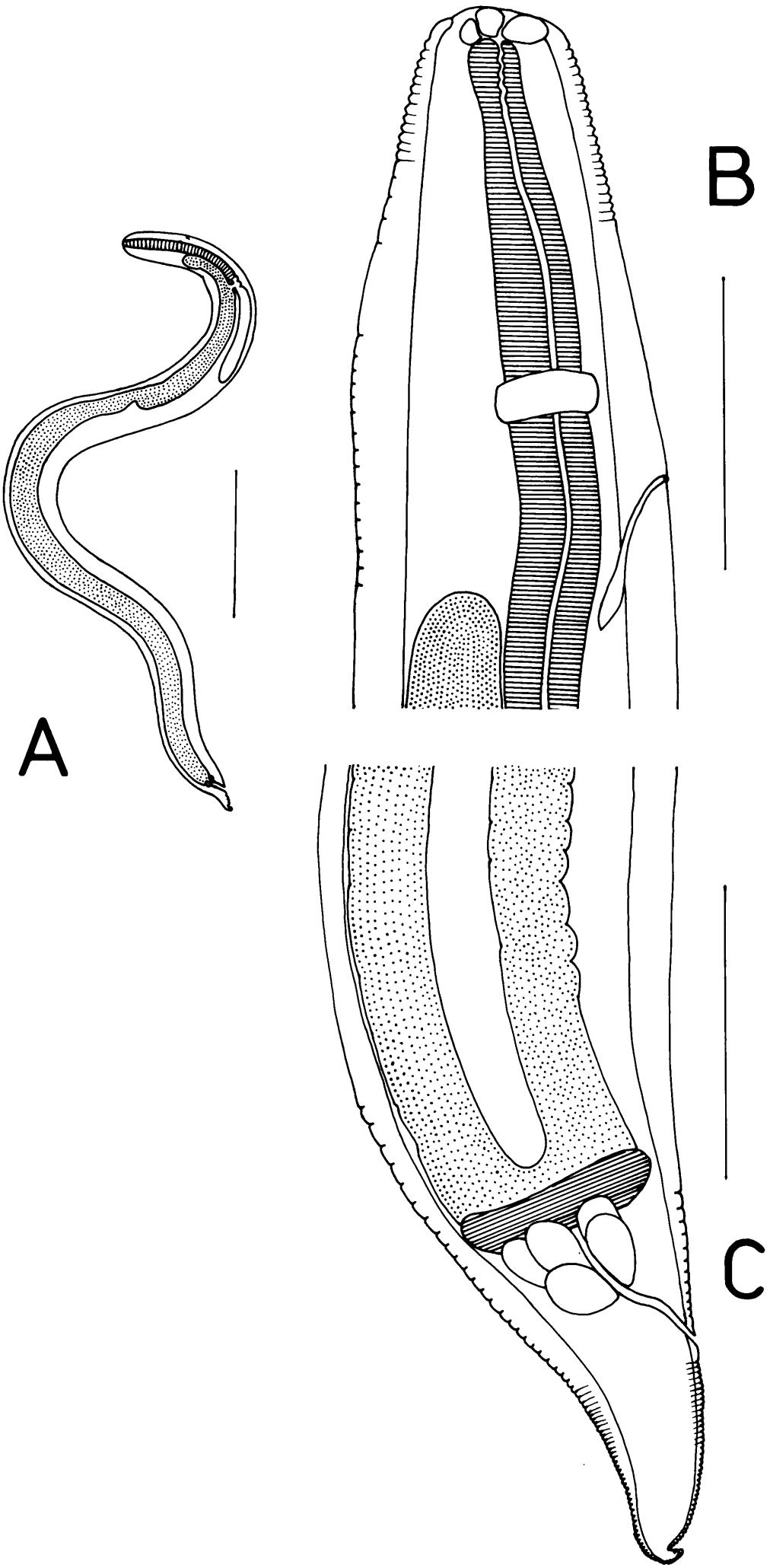
Character	Present specimen	Cannon (1977) (mm)
Body length	2491	8.49 ± 1.98 (range 1.78-12.59)
Maximum width	196	0.213 ± 0.055 (range 0.086-0.325)
Anterior end to:		
- nerve ring	114	0.241 ± 0.058 (range 0.130-0.335)
- excretory pore	186	0.324 ± 0.080 (range 0.167-0.465)
- tip of caecum	215	-
Length of:		
- muscular oesophagus	413	0.847 ± 0.228 (range 0.241-1.395)
- ventriculus	62	0.067 ± 0.021 (range 0.026-0.149)
- ventriculus appendix	355	4.691 ± 1.260 (range 0.930-7.250)
- intestinal caecum	207	0.495 ± 0.179 (range 0.052-1.100)
- tail	83	0.110 ± 0.027 (range 0.055-0.167)
Body width at level of anus	52	0.074 ± 0.16 (range 0.034-0.111)
Host:	*Acanthopagrus australis*	*Amentum devisi* (CLUPEIDAE); *Saurida undosquamis* (SYNODONTIDAE); *Paraplotosus albilabris* (PLOTOSIDAE); *Tachysaurus australis* (TACHYSAURIDAE); *Mylio australis* (SPARIDAE); and others.
Site in host:	debris	visceral mesenteries
Locality:	Red Rock Estuary, NSW	South-eastern Queensland
Source:	This study	Cannon (1977)

PLATE: 21. *Hysterothylacium* Ward and Magath, 1917 syn.
Thynnascaris sp., Type 1, Larva, Cannon, 1977

A. Whole mount, lateral view; scale length 0.5 mm

B. Anterior end, lateral view; scale length 0.1 mm

C. Posterior end, lateral view; scale length 0.1 mm


A
B
C

Order : SPIRURIDA Diesing, 1861

Suborder : CAMALLANINA sensu Chabaud

Superfamily : CAMALLANOIDEA Railliet and Henry sensu Chabaud

Family : CAMALLANIDAE Railliet and Henry, 1915

Genus : *Spirocamallanus* Olsen, 1952

Spirocamallanus sp.

Specimen deposited: W199692.

Collection data:

- Number of worms measured: 1 female
- Site in host : intestine
- Locality : Red Rock National Park (NSW)

Description:

6 mm long, 727 wide. Lips lacking. Head with 4 (2 pairs) of cephalic papillae. Cuticle very thin with delicate striations. Buccal capsule 58 x 41, with 14 spiral bands and without posterior ridge. Nerve ring 186, excretory-pore 281 and vulva 1139, from anterior end respectively. Muscular part of oesophagus 331 x 62, glandular part 347 x 60. Tail with digitiform appendage bearing two bifurcate terminal spines.

Remarks:

This specimen resembles *Spirocamallanus platycephali* Hooper, 1983, *S. ditchelli* Gupta and Garg, 1976, *S. cricotus* Fusco and Overstreet, 1978, *S. halitrophus* Fusco and Overstreet, 1978, *S. penneri* Fusco and Brooks, 1978, *S. pereirai* (Annereaux 1946) Olsen 1952 (Noble and King, 1960), and *S. berdii* Khan and Yaseen, 1969. All those species have two spines on the tail.

My specimen differs from Hooper's in having 14 spiral thickenings and no posterior buccal capsule ridge, compared with 12 spiral thickenings and a prominent posterior buccal capsule ridge as wide as the

anterior part of the oesophagus in Hooper's material. Also Hooper's female specimens have the vulva posterior to the middle of the body.

My specimen differs from *S. cricotus* Fusco and Overstreet, 1978, *S. halitrophus* Fusco and Overstreet, 1978 and *S. penneri* Fusco and Brooks, 1978 in having two pairs of head papillae, whereas specimens of Fusco and Overstreet, 1978 have 3 concentric rings of 4 papillae each. *S. berdii* Khan and Yaseen, 1969 has 9 spiral thickenings and the posterior part of the body is rounded.

Based on these differences, it is very likely that my specimen of *Spirocamallanus* sp. belongs to a new sp.; however, since only a single specimen is available, the establishment of a new species is postponed.

Table 4.17. Comparison between female of *Spirocamallanus* sp. and related species. All measurements are in micrometres unless otherwise indicated.

Character	*S. acanthopagri*	*S. platycephali*	*S. cricotus*	*S. halitrophus*	*S. penneri*	*S. ditchelli*	*S. berdii*	*S. pereirai*
Body length (mm)	6	6.27 - 8.56	17.3 - 32.0	22.5 - 44.5	11.4 - 16.2	5.312-11.394	18.9-20.76	10.5 - 26.5
Maximum width	727	115 - 370	260 - 476	220 - 325	402 - 684	0.154-0.216mm	0.37 mm	235 - 710
Head papillae	2 pairs	4	3 concentric rings of 4	3 concentric rings of 4	3 concentric rings of 4	-	-	-
Buccal capsule:								
- diameter	58x41	90-104x60-72	72-83x53-77	96-121x84-96	104-122x90-99	0.038-0.045 x0.018-0.032 mm	0.1x0.8mm	71-81x66-92
- no.of spiral bands	14	11 - 12	10 - 15	10 - 14	12 - 17	12	15	11 - 14
- basal ledge	absent	present, disctinct	present, distinct	present, narrow	?	?	?	?
Length of:								
- muscular oesophagus	331x62	650 - 680	420 - 593	454 - 609	413 - 494	0.218-0.307mm	0.40-0.50mm	350-530
- glandular oesophagus	347x60	810 - 850	538 - 834	696 - 963	580 - 754	0.269-0.365mm	0.80-0.90mm	535-897
Anterior end to:								
- nerve ring	186	360 - 380	192 - 328	293 - 348	270 - 322	?	0.25 mm	280-310
- excretory pore	281	350 - 370	383 - 648	?	402 - 459	?	?	500-530
- vulva	1139	3.65 - 4.60mm	9.1 -16.8mm	11.8 -22.2mm	5.0 -7.6mm	2.624-4.684mm	8.65-9.32mm	6.9-9.3mm
Tail:								
- with digit	present	present	present	present	present	present	-	present
- with spines	present	present	present	present	?	present	-	present
Host	*Acanthopagrus australis*	*Platycephalus fuscus*	*Micropogonias undulatus* and others	*Syacium papillosum* and others	*Trachycorystes insignis*	*Pellona ditchelli*	*Sparus berda*	*Mugil spp.* and others
Site in host	intestine	intestine and rectum	intestine	?	intestine	intestine	intestine	intestine
Locality	Red Rock Estuary, NSW	Red Rock Lagoon, NSW	Mississippi, USA	Florida, USA	Columbia, USA	Port Blair, Andaman and Nicobar Is.	East Pakistan	California, and Karachi
Source	This study	Hooper, 1980	Fusco and Overstreet, 1978	Fusco and Overstreet, 1978	Fusco and Brooks, 1978	Gupta and Garg, 1976	Khan and Yaseen, 1969	Noble and King (1960); Rasheed (1970) (see Hooper, 1983)

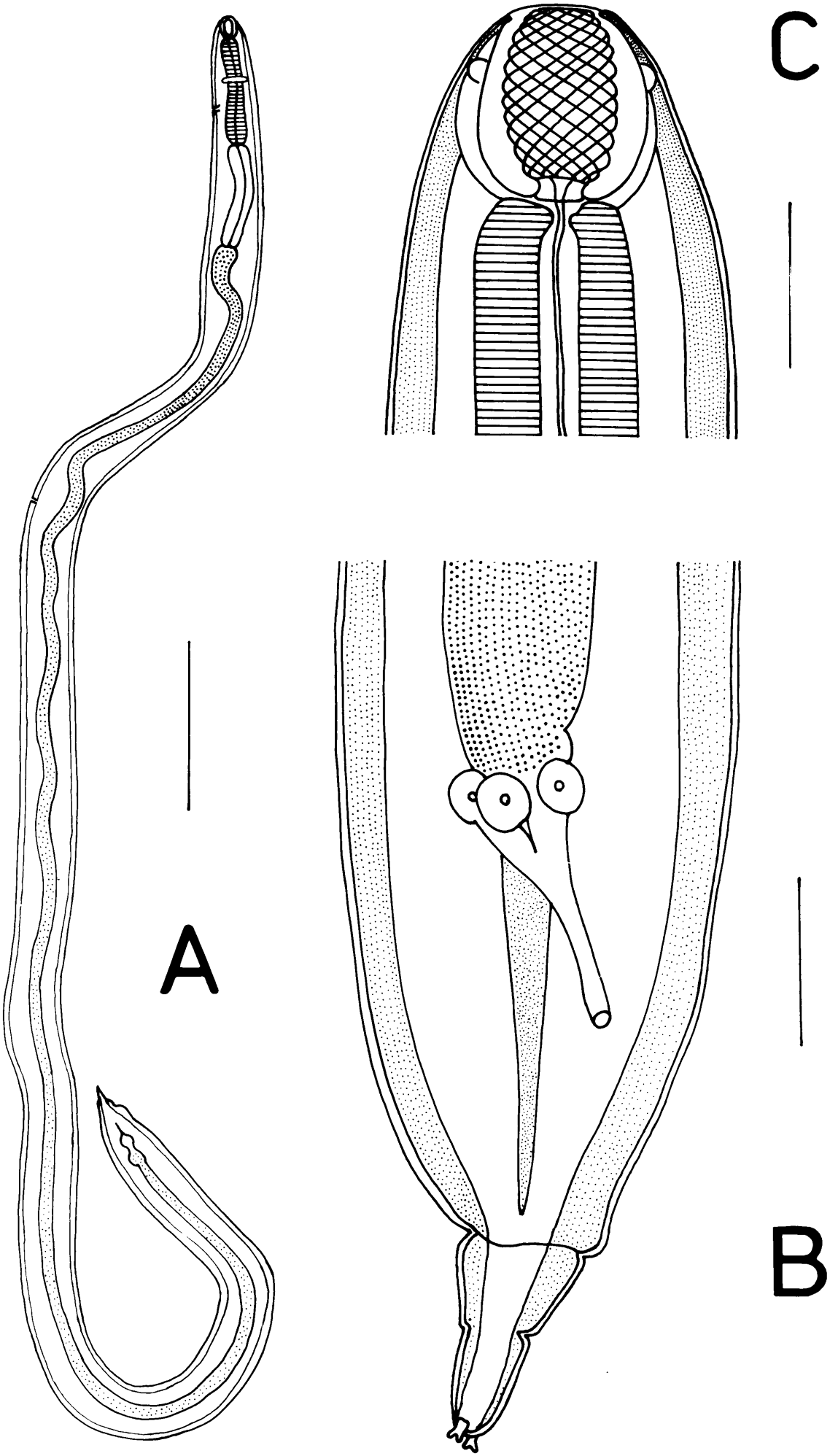
PLATE 22: *Spirocamallanus* sp.

A. Whole mount, ventro-lateral view.

B. Posterior end, ventral view.

C. Anterior end, lateral view.

Scale length 0.5 mm.


C
A
B

Order : SPIRURIDA Diesing, 1861

Superfamily : SEURATOIDEA Chabaud, 1978

Family : CUCULLANIDAE Cobbold, 1864

Subfamily : CUCULLANINAE (Cobbold, 1864)

Genus : *Cucullanus* Mueller, 1777

C. acanthopgari n. sp.

Specimens deposited: W199700.

Collection data:

- Number of worms measured: 2 males
- Site in host : intestine
- Locality : Red Rock Estuary (NSW)

Description:

Body length 5.10 (2.6-7.5) mm. Body with fine striations. Two lateral lips present, bordered with collarette forming low cuticular wall bearing 60 pseudobuccal teeth. Oesophagus length 786 (661-911), oesophagus anterior diameter 426 (355-496), posterior diameter 360 (306-413). Anterior end to nerve ring 310 (248-372), to deirids 537 (only in one specimen observed), to excretory pore 1243 (observed only in one specimen). Tail curved ventrally, 187 (134-240), end of tail pointed. Body width: in head region 179 (126-231), at nerve ring 159 (153-165), at oesophagus-intestine 210 (196-223), maximum 232 (207-256), at anus 73 (58-87). Intestinal caecum absent. Preanal sucker present. Cuticle thickness 6, even throughout the body. Right spicule 624 (479-769), left spicule 679 (488-870). Caudal papillae 10 pairs, 6 preanal, 4 postanal. Accessory piece (gubernaculum) 99 (83-114) near tip of spicules. Testis single.

Remarks:

My specimens are similar in many respects to *Cucullanus carettae* Baylis, 1923, *C. barbi* Baylis, 1923, *C. clarotis* Baylis, 1923 , *C. elongatus* Smedley, 1923, (see Berland, 1983), *C. australiensis* Baylis, 1927, *C. hansoni* Olsen, 1952, *C. sigani* Yamaguti, 1954, and *C. heterochrous* (Berland, 1970). However, they differ from *C. carettae* and *C. clarotis* in the number of caudal papillae which are 10 pairs, compared with 1 pair and 11 pairs in *C. carettae* and *C. clarotis*, respectively. They differ from *C.barbi* in a shorter tail which is 187 (134-240) compared with 370 in *C. barbi*; in the spicules which are unequal and shorter (624 and 679) in mine, whereas they are equal and 1300 long in *C. barbi*. They also differ from *C. elongatus* in a much shorter body which is 5.1 (2.6-7.5) mm in my material, whereas it is 25.5-30.9 mm in *C. elongatus*. Other differences are the oesophagus length which is 7286 (661-911) in my specimens and 1957-2318 in *C. elongatus* ; and the arrangement of the caudal papillae, i.e. my material has 6 pairs of preanal and 4 pairs of postanal papillae whereas *C. elongatus* has 5 pairs each of pre- and postanals. The new species differs from *C. heterochrous* in the number of caudal papillae and their arrangement. There are 11 pairs of caudal papillae in *C. heterochrous*, compared with 10 pairs of caudal papillae in my material. My specimens differ from *C. hansoni* in a longer body, which is 3.49-5.00 mm in *C. hansoni* and 5.1 (2.6-7.5)mm in my material; in smaller oesophagus dimensions, i.e. 430-510 length, 120-150 anterior diameter and 100-127 posterior diameter in *C. hansoni* , compared with 786 (661-911), 426 (355-496) and 360 (306-413) respectively in my material; in the spicules which are equal in *C. hansoni* and unequal in my material; and in the number and arrangement of the caudal papillae, i.e. there are 11 pairs of caudal papillae, arranged in 3 pre-, 5 ad- and 3 postanal papillae in *C. hansoni*, compared with 6 pre- and 4 postanal pairs of papillae in

my specimens. The new species differs from *C. sigani* in a shorter body, in the presence of unequal spicules, and in the arrangement of caudal papillae. My specimens have 6 pairs of preanal and 4 pairs of postanal papillae, whereas *C. sigani* has 5 pairs of each.

My specimens are of similar size to *rivulatus* Soota and Sarkar, 1980; *C. alii* (Kalyankar, 1971) Petter, 1974 (see Soota and Sarkar, 1980) and *C. arabiansae* (Ali and Kalyankar, 1966) Petter, 1974 (see Soota and Sarkar, 1980).

The new species differs from *C. rivulatus, C. alii* and *C. arabiansae* in having unequal spicules, simple gubernaculum, and 10 pairs of caudal papillae, compared with equal spicules in *C. rivulatus, C. alii and C. arabiansae;* V-shaped gubernaculum in *C. rivulatus* and *C. alii*; 8 pairs of caudal papillae in *C. arabiansae*, 10-12 pairs in *C. alii;* and 9 pairs in *C. arabiansae*. Whereas my specimens have a pointed tail, *C. arabiansae* has a conical tail.

Although Baylis (1923) recorded *C. australiensis* from the intestine of Reef-eel in Queensland, which is relatively close to the area where my new species was found, the sizes of the Baylis specimens are much larger than mine. Also they have a different arrangement of the caudal papillae.

I call my new species, *C. acanthopagri*. The species name refers to the host genus.

Table 4.18. Comparison between males of *Cucullanus acanthopagri* n. sp. and related species. All measurements are in micrometres unless otherwise indicated.

Character	*C. acanthopagri*	*C. heterochrous*	*C. australiensis* (mm)	*C. carettae* (mm)	*C. rivulatus* (mm)	*C. alli* (mm)	*C. arabiansae* (mm)
Body length (mm)	5.10 (2.6-7.6)	5.33-7.55	13-17	12-14	4.5-7.5	2.4-6.0	5.4
Oesophagus:							
- length	786 (661-911)	0.770-0.935 mm	-	1.5-1.7	0.75-1.16	0.6-0.7	0.9
- anterior diameter	426 (355-496)	0.165-0.193 mm	-	0.3-0.32	-	-	-
- posterior diameter	360 (306-413)	0.101-0.132 mm	-	-	-	-	-
Anterior end to:							
- nerve ring	310 (248-372)	0.310-0.376 mm	0.35-0.35	0.6-0.7	-	-	-
- deirids	537	0.690-0.745 mm	0.75-0.85	1.0-1.05	-	-	-
- excretory pore	1243	0.906-1.08 mm	-	1.0-1.1	-	-	-
Tail	pointed	0.154-0.193 mm	0.3	0.3	0.2 -0.22	0.1-0.2	conical
Body width:							
- in head region	179 (126-231)	0.180-0.210 mm	-	0.32-0.37	-	-	-
- at nerve ring	159 (153-165)	0.154-0.196 mm	-	-	-	-	-
- at oesophagus-intestine	210 (196-223)	0.165-0.216 mm	-	-	-	-	-
- maximum	232 (207-256)	0.165-0.216 mm	0.33-0.37	0.43-0.53	0.55-0.70	0.22-0.38	0.24
- at level of anus	73 (58-87)	0.084-0.099 mm	-	-	-	-	-
Cuticle thickness	6	3-6	-	-	-	-	-
Cuticle straitions	fine	-	fine	present	-	-	-
Right spicule	624 (479-769)	0.710-0.970 mm	1.2	1.4-1.5	0.7-0.9	0.8-0.9	0.13
Left spicule	679 (488-870)	0.775-1.080 mm	1.2	1.4-1.5	0.7-0.9	0.8-0.9	0.13
Gubernaculum	99 (83-114) (simple)	0.046-0.059 mm	0.21	-	0.05-0.1 (V-shaped)	0.05-0.1 (V-shaped)	0.9
Caudal papillae	10 pairs	11 pairs	10 pairs	1 pair	8 pairs	10-12 pairs	9 pairs
Host:	*Acanthopagrus australis*	*Platichthys flessus*	'Reef Eel'	*Thalassochelys caretta* and *T. corticata*	*Pomadasys* sp.	*Protonibea diacanthus*	*Tachysurus* sp.
Site in host:	intestine	intestine	intestine	stomach and intestine	intestine	intestine	intestine
Locality	Red Rock Estuary NSW	Norway	Queensland	-	Madras- India	Madras- India	Mangalore -India
Source:	This study	Berland, 1980	Baylis, 1927	Baylis, 1923	Soota and Sarkar, 1980	Soota and Sarkar, 1980	Soota and Sarkar, 1980

Continued

Table 4.18 (Cont'd)

Character	*C. barbi* (mm)	*C. clarotis* (mm)	*C. elongatus* (mm) Cape Mudge	*C. elongatus* (mm) Nanaimo	*C. hansoni* (mm)	*S. siganı* (mm)
Body length (mm)	15.5	7-10	27.96-30.29	25.54-30.9	3.49-5.00	8.2-9.7
Oesophagus:						
- length	-	-	2.077-2.229	1.957-2.318	0.43-0.57	0.7-0.73
- anterior diameter	-	-	0.233-0.274	0.225-0.255	0.12-0.15	0.165
- posterior diameter	-	-	0.214-0.246	0.189-0.260	0.10-0.127	0.165
- nerve ring	0.5-0.58	0.35-0.38	0.564-0.611	0.532-0.598	0.21-0.24	0.30-0.32
- deirids	0.82	0.6-0.64	1.269-1.359	0.178-1.444	0.52	0.6-0.6
- excretory pore	0.67	0.5	1.645-1.842	1.628-1.823	-	0.88-0.94
Tail	0.37	0.13-0.15	0.233-0.307	0.218-0.273	0.13-0.17 pointed	0.224
Body width:						
- in head region	-	-	0.255-0.308	0.237-0.260	-	-
- at nerve ring	-	-	0.266-0.304	0.249-0.290	-	-
- at oesophagus-intestine	-	-	0.344-0.436	0.308-0.373	-	-
- maximum	0.51	0.4-0.6	0.325-0.488	0.384-0.425	0.16-0.26	0.35-0.38
- at level of anus	-	-	0.163-0.189	0.160-0.184	-	-
Cuticle thickness	-	-	-	-	-	-
Cuticle striations	2	very fine, irregular	-	-	-	-
Right spicule	equal	equal	1.250-1.470	1.19-1.52	equal	equal
Left spicule	1.3	0.8	1.300-1.404	1.19-1.45	0.65-0.87	1.2-1.4
Gubernaculum	0.1	0.08	0.093-0.189	0.064-0.101	0.022-0.031	0.11-0.13
Caudal papillae	10 pairs	11 pairs	10 pairs	10 pairs	11 pairs	10 pairs
Host:	*Barbus bynni*	*Clarotes laticeps*	*Ophiodon elongatus*	*Ophiodon elongatus*	*Balistes capistratus* (trigger-fish)	*Siganus*
Site in host	-	-	intestine	intestine	intestine	small intestine
Locality:	Khartoum	Khartoum	Cape Mudge	Nanaimo, Johnston Strait	Honolulu, Hawaii	Macassar
Source:	Baylis, 1923	Baylis, 1923	Pacific Coast of Canada, Berland, 1983		Olsen, 1952	Yamaguti, 1954