

Digenean Trematodes from Pomacanthid Fishes of Japan and Palau

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Abstract Eight species of digenean trematodes are recorded from pomacanthid fishes of Japan and Palau. They are: *Paragyliuchen chaetodontis* Yamaguti, 1934 (Gyliuchenidae); *Pseudantorchis apolemichthydis* sp. nov. (Fellodistomidae); *Antorchis tsushimaensis* (Machida, 1971) (Faustulidae); *Pseudobacciger harengulae* (Yamaguti, 1938) (Faustulidae); *Allobacciger centropygis* sp. nov. (Monorchiidae); *Lepotrema clavatum* Ozaki, 1932 (Lepocreadiidae); *Neopreptetos arusettae* Machida, 1982 (Lepocreadiidae); and *Duosphincter zancli* Manter & Pritchard, 1960 (Hemiuridae). The genus *Allobacciger* is transferred from the family Fellodistomidae to the Monorchiidae.

Key words : digenean trematodes, pomacanthid fishes, new species, Japan, Palau

This paper deals with eight species of digenean trematodes including two new species from pomacanthid fishes (Fam. Pomacanthidae) of Japan and Palau. The digeneans collected were washed in saline, fixed in AFA under slight pressure, stained with Heidenhain's hematoxylin and mounted in balsam. The specimens are deposited in the National Science Museum, Tokyo (NSMT). Measurements are given in millimeters unless otherwise stated.

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Family Gyliuchenidae

Paragyliuchen chaetodontis Yamaguti, 1934

Material. From rectum of *Chaetodontoplus septentrionalis*, Tsushima, Nagasaki Prefecture, Japan, 30-IV-1974 (NSMT-PI 1620); rectum of *C. septentrionalis*, Tsushima, 6-V-1974 (NSMT-PI 1661); rectum of *Genicanthus melanospilos*, Koniya, Kagoshima Prefecture, Japan, 20-XI-1985 (NSMT-PI 3217); and rectum of *G. la-*

marck, Koniya, 20-XI-1985 (NSMT-PI 3218).

Remarks. The body is robust so that the genital pore is changeable in position by flattening, from anterosinistral to the pharynx to posterior to the caecal bifurcation.

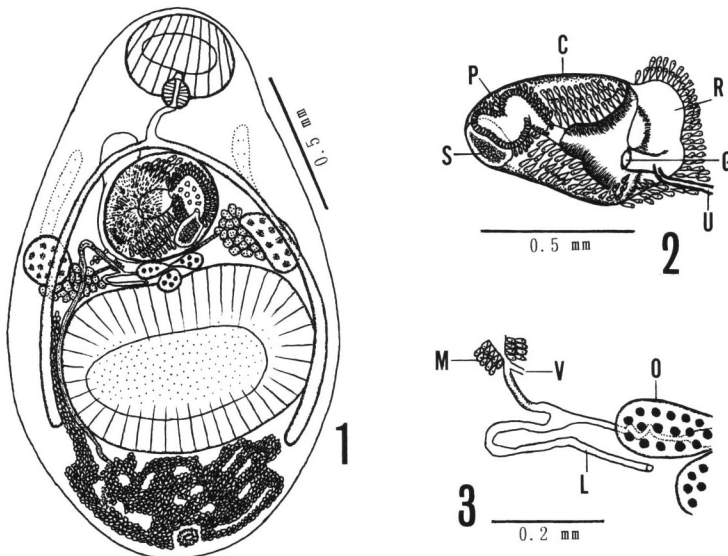
Family Fellodistomidae

Pseudantorchis apolemichthydis sp. nov.

(Figs. 1–3)

Material. From intestine of *Apolemichthys trimaculatus*, Irabu, Okinawa Prefecture, Japan, 9-V-1978 (NSMT-PI 2151, 1 paratype, abnormal in egg formation, uterus filled with granules); intestine of *A. trimaculatus*, Naze, Kagoshima Prefecture, Japan, 5-VIII-1978 (NSMT-PI 5159, 1 paratype); and intestine of *A. trimaculatus*, Naze, 10-IV-1982 (NSMT-PI 5161, holotype & 3 paratypes).

Description. Based on 6 specimens. Body stout, ovoid, 1.48–1.86 long by 1.01–1.28 wide. Tegument smooth. Oral sucker subterminal, 0.23–0.33×0.34–0.39; prepharynx very short, up to 50 μm long; pharynx globular, 65–85×70–100 μm; esophagus sometimes curved, 0.13–0.26 long, bifurcating immediately anterior to cirrus sac; caeca extending near posterior border of acetabulum or slightly beyond it. Acetabulum large, wider than long, 0.43–0.62×0.71–0.88. Sucker ratio 1:2.0–2.4. Forebody 61–67% of body length. Postacetabular space 15–24% of body length.



Figs. 1–3. *Pseudantorchis apolemichthydis* sp. nov. — 1. Entire worm, dorsal view (NSMT-PI 5161, holotype). 2. Terminal genitalia, ventral view. 3. Ovarian complex, dorsal view. C, cirrus sac; G, genital pore; L, Laurer's canal; M, Mehlis' gland; O, ovary; P, prostatic vesicle; R, recess; S, seminal vesicle; U, metraterm; V, vitelline reservoir.

Testes rounded to ovoid, on or near lateral body margin, usually overlapping caeca in part, between cirrus sac and acetabulum or anterolateral to acetabulum, right testis $0.16\text{--}0.43 \times 0.13\text{--}0.21$ and left testis $0.14\text{--}0.41 \times 0.08\text{--}0.20$. Cirrus sac large, ovoid to funnel-shaped, lying transversely, between caecal bifurcation and acetabulum, $0.40\text{--}0.62 \times 0.28\text{--}0.43$; including rounded to oval seminal vesicle $0.10\text{--}0.22 \times 0.08\text{--}0.21$; thick saccular to tubular, usually twisted prostatic vesicle $0.16\text{--}0.37$ long, with prostatic cells; and cup- or funnel-shaped cirrus which is lined with fur-like spines and surrounded by glandular cells. Areola $0.03\text{--}0.04$ long is observed between prostatic vesicle and cirrus. Irregular-shaped recess longitudinally elongated, $0.28\text{--}0.42$ long, without spines, surrounded by glandular cells, left side of cirrus sac. Genital atrium short, cylindrical. Genital pore in posterosinistral region of cirrus sac.

Ovary trilobed, $0.10\text{--}0.32 \times 0.11\text{--}0.39$ as a whole, median, maybe shifting the position to right or left depending on flattening, between cirrus sac and acetabulum. Seminal receptacle absent. Laurer's canal opening dorsally mid- to near postovarian level. Vitellaria acinous, in lateral clusters, just anterior or posterior to or inside of testes. Uterus filling available space of hindbody; metraterm short and slender, joining genital atrium near the base. Eggs $18\text{--}23 \times 12\text{--}14 \mu\text{m}$. Excretory vesicle Y-shaped, stem bifurcating mid- or postacetabular level, arms extending bifurcal to esophageal level; pore middorsal, $0.05\text{--}0.15$ away from posterior end of body.

Remarks. Wang (1982) described *Pseudantorchis thalassomae* as a new genus and species from *Thalassoma hardwicki* (Fam. Labridae) from Fujian Province, China. Wang's description and illustration were so poor that we made only a rough comparison between our specimens and his. For example, he did not show the structure of the terminal genitalia and the form of the excretory vesicle. In our specimens, the cirrus sac contains a cup- or funnel-shaped cirrus with spines, a recess is present on the left side of cirrus sac, no seminal receptacle, the excretory vesicle is Y-shaped with a stem, and the excretory pore lies dorsally, slightly away from the posterior extremity. We agree with Bray (1988) that *Pseudantorchis* is assigned to the subfamily Fellodistominae of the family Fellodistomidae. We give here a detailed description of our specimens as the second species of *Pseudantorchis*. Additional observation on *P. thalassomae* should be requested.

Compared with *P. thalassomae*, differences are seen in that *P. thalassomae* has testes located posterolateral to the acetabulum, and a genital pore lying posterosinistral to the caecal bifurcation.

Family Faustulidae

Antorchis tsushimaensis (Machida, 1971)

(Fig. 4)

Material. From pyloric caeca of *Apolemichthys trimaculatus*, Koniya, Kagoshima Prefecture, Japan, 21-XI-1985 (NSMT-PI 3221); and upper intestine of

Pomacanthus semicirculatus, Nago, Okinawa Prefecture, Japan, 20-V-1993 (NSMT-PI 4405).

Description. Ten specimens from *Apolemichthys trimaculatus* (Fig. 4) are: Body nearly oval, 1.12–1.85 long by 0.95–1.21 wide. Tegument with spines. Oral sucker 0.19–0.23×0.19–0.28; pharynx 0.05–0.07×0.06–0.08; esophagus 0.05–0.26 long; caeca usually terminating a little beyond testes. Acetabulum 0.21–0.26×0.21–0.27. Sucker ratio 1:0.84–1.12. Forebody 57–72% of body length. Right testis 0.15–0.31×0.16–0.25 and left testis 0.16–0.33×0.12–0.24. Posttesticular space 40–55% of body length. Cirrus sac elliptical with protrudent cirrus, 0.32–0.50×0.20–0.29. Cirrus without spines. Genital pore usually slightly postbifurcal, occasionally bifurcal or slightly prebifurcal, 26–33% of body length from anterior extremity. Ovary 0.13–0.21×0.11–0.16. Eggs 28–34×13–17 μm . Excretory vesicle V- or Y-shaped, arms extending to midtesticular level.

Ten specimens from *Pomacanthus semicirculatus* are: Body pyriform, 2.02–3.03 long by 1.38–1.55 wide. Tegument with spines. Oral sucker 0.27–0.36×0.31–0.40; pharynx 0.06–0.09×0.09–0.11; esophagus 0.26–0.65 long; caeca usually extending anterior border of testes or rarely not touching them. Acetabulum 0.24–0.36×0.26–0.33. Sucker ratio 1:0.73–1.01. Forebody 56–71% of body length. Right testis 0.22–0.35×0.18–0.31 and left testis 0.16–0.38×0.16–0.35. Posttesticular space 40–50% of body length. Cirrus sac nearly fusiform, 0.51–0.89×0.24–0.29. Cirrus without spines. Genital pore usually slightly prebifurcal, occasionally bifurcal or slightly postbifurcal, 31–43% of body length from anterior extremity. Ovary 0.18–0.25×

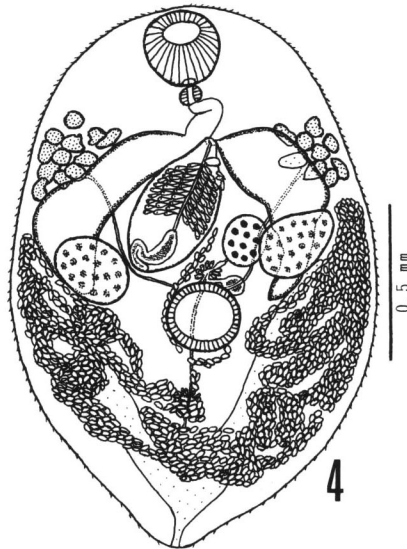


Fig. 4. *Antorchis tsushimaensis* (Machida, 1971) from *Apolemichthys trimaculatus*, entire worm, ventral view (NSMT-PI 3221).

0.15–0.22. Eggs $27\text{--}34 \times 16\text{--}19 \mu\text{m}$. Excretory vesicle V-shaped, arms terminating near postacetabular level.

Remarks. Machida and Uchida (1990) reduced *Antorchis chaetodontis* (Yamaguti, 1934) and *A. tsushimaensis* (Machida, 1971) to be synonymous with *A. urna* (Linton, 1910). Cribb *et al.* (1999) did not accept the synonymy for the following reasons: the oral sucker of *A. urna* is distinctly funnel-shaped, whereas those of *A. chaetodontis* and *A. tsushimaensis* are subspherical; the genital pore of *A. urna* is associated closely with the acetabulum whereas that of *A. tsushimaensis* is clearly not; and the caeca of *A. urna* are short and divergent whereas those of *A. chaetodontis* extend past the acetabulum. Certainly *A. chaetodontis* and *A. tsushimaensis* can be separated from *A. urna* by the genital pore of the former two lying at or near the caecal bifurcation. *A. chaetodontis* has a sucker ratio of about 1 : 2, and caeca being slender and extending past the acetabulum to the anterior end of posterior third of the body. We have not collected such a specimen as *A. chaetodontis* before.

Pseudobacciger harengulae (Yamaguti, 1938)

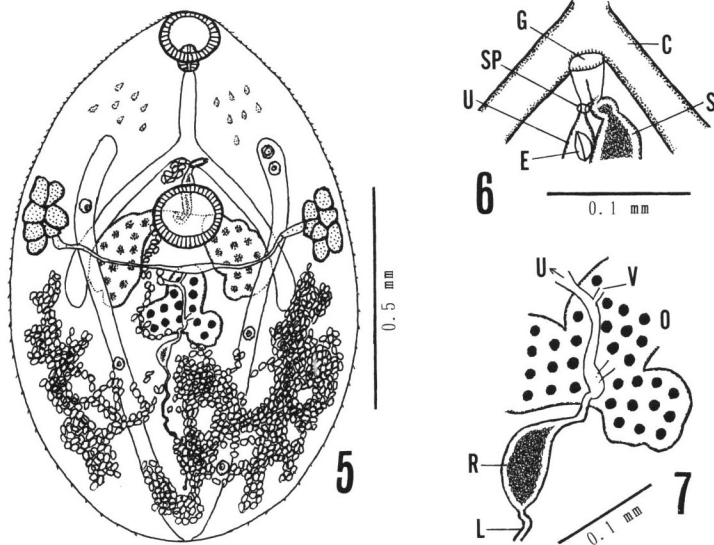
(Figs. 5–7)

Material. From pyloric caeca and upper intestine of *Genicanthus lamarck*, Koniya, Kagoshima Prefecture, Japan, 13-XI-1985 (NSMT-PI 3170).

Description. Based on 4 specimens. Body oval, 0.92–1.27 long by 0.67–0.89 wide. Tegument with fine spines. Cervical glands present. Oral sucker rounded, subterminal, $84\text{--}115 \times 113\text{--}143 \mu\text{m}$; prepharynx up to $18 \mu\text{m}$ long; pharynx subglobular, $61\text{--}69 \times 56\text{--}64 \mu\text{m}$; esophagus $115\text{--}179 \mu\text{m}$ long, bifurcating much nearer acetabulum than pharynx; caeca slightly curved inward and broader at the posterior ends, and terminating near posttesticular level or more posteriorly. Acetabulum rounded, $135\text{--}158 \times 140\text{--}166 \mu\text{m}$. Sucker ratio 1 : 1.14–1.25. Forebody 35–45% of body length.

Testes ovoid with uneven surface, symmetrical, intercaecal, extending anteriorly near midacetabular level, overlapping acetabulum in part; right testis $171\text{--}237 \times 115\text{--}186 \mu\text{m}$ and left testis $179\text{--}222 \times 128\text{--}201 \mu\text{m}$. Seminal vesicle small, longitudinally elongated, bipartite with nearly equal portions or slightly larger posterior portion; anterior portion $52\text{--}95 \times 20\text{--}40 \mu\text{m}$ and posterior portion $65\text{--}98 \times 18\text{--}40 \mu\text{m}$, sometimes turned anteriorly at the posterior end, from mid- to postacetabular in posterior extent. Short male duct projecting into genital atrium which is cup-shaped, $25 \times 25 \mu\text{m}$.

Ovary trilobed with irregular surface, $140\text{--}204 \times 66\text{--}209 \mu\text{m}$, just or some distance posterior to acetabulum, with its anterior end at mid- to posttesticular level. Oviduct arising from middle of ovary and divided into two ducts. The ascending duct connecting with vitelline reservoir near anterior edge of ovary and then entering into ootype. The descending duct joining seminal receptacle, $85\text{--}90 \times 45\text{--}52 \mu\text{m}$, immediately posterior to ovary. Laurer's canal originating from posterior end of seminal receptacle, descending, slightly sinuous, and opening dorsally just anterior to or on di-



Figs. 5–7. *Pseudobacciger harengulae* (Yamaguti, 1938). — 5. Entire worm, ventral view (NSMT-PI 3170). 6. Terminal genitalia, ventral view. 7. Ovarian complex, ventral view. C, caecum; E, egg; G, genital pore; L, Laurer's canal; O, ovary; R, seminal receptacle; S, seminal vesicle; SP, sphincter; U, uterus; V, vitelline reservoir.

vergence of excretory vesicle, 113–123 μm away from posterior extremity. Vitellaria composed of 6 or 7 relatively large follicles, symmetrical, outside of excretory arms at acetabular level. Each vitelline duct running inward across midventral region of testes, and joining near anterior edge of ovary. Uterus lying in posterior space of gonads and ascending right side of acetabulum. Small sphincter is observed immediately before the union with genital atrium. Eggs 22–25 \times 15–18 μm . Excretory vesicle V-shaped, arms crossing near caecal termination, passing between testis and vitellaria, slightly curved inward, and ending just anterior to bifurcal or midesophageal level; pore terminal. Each arm containing up to 10 round concretions, 15–31 μm in diameter.

Remarks. Three species of *Pseudobacciger* have been described: *P. harengulae* (Yamaguti, 1938), *P. manteri* Nahhas & Cable, 1964 and *P. cablei* Madhavi, 1975.

Dimitrov *et al.* (1999) considered these three species to be valid, and showed considerable variation in *P. harengulae* and differential characters to distinguish species. Variation within *P. harengulae* seems to make the status of each of the three species rather obscure. With the exception of small seminal vesicle, our specimens are larger worms with correspondingly larger organs than those of the previously published descriptions. Following differential characters presented by Dimitrov *et al.* (1999), our specimens are placed in *P. harengulae*.

Family Monorchiidae
Allobacciger centropygis sp. nov.

(Figs. 8–10)

Material. From upper intestine of *Centropyge heraldi*, Koniya, Kagoshima Prefecture, Japan, 21-XI-1989 (NSMT-PI 3814, holotype & 14 paratypes).

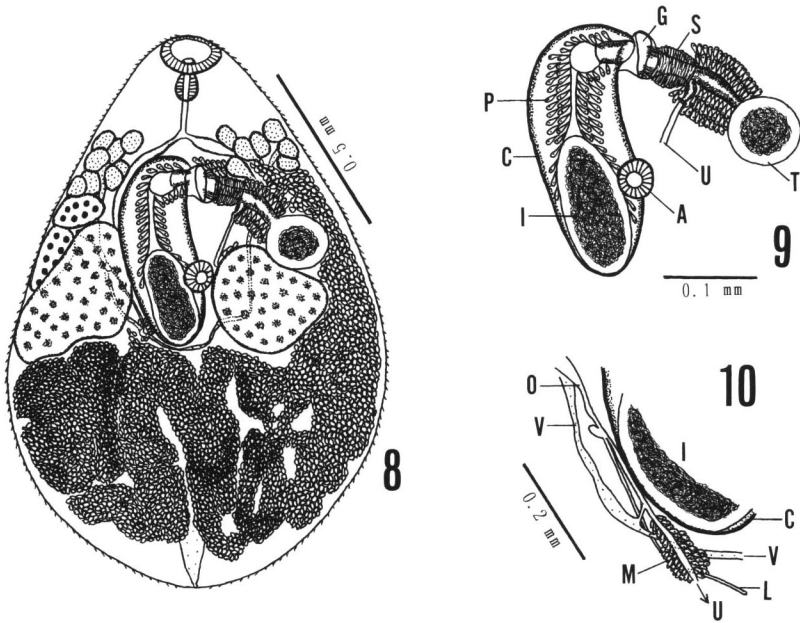
Description. Based on 15 specimens. Body ovoid, slightly pointed anteriorly and rounded posteriorly, 1.30–1.58 long by 0.92–1.13 wide. Tegument with spines. Oral sucker subterminal, ovoid, 0.07–0.14×0.14–0.20; prepharynx very short, up to 0.05 long; pharynx rounded to elliptical, 0.05–0.09×0.06–0.08; esophagus with weak circular muscle, 0.04–0.10 long, bifurcating at anterior one-third of forebody or more posteriorly; caeca slender, arcuate, extending beyond testes. Acetabulum rounded, 0.08–0.12×0.08–0.14. Sucker ratio 1:0.5–0.8. Forebody 37–46% of body length.

Testes ovoid, symmetrical, near midbody; right testis 0.25–0.41×0.26–0.43 and left testis 0.17–0.43×0.20–0.41. Cirrus sac stout, thick-walled, curved sinistrally at distal end and overlapping acetabulum in part near proximal end, 0.37–0.62×0.15–0.22, extending slightly posterior to acetabulum; containing oval seminal vesicle, slender pars prostatica with prostatic cells, and cirrus. Cirrus eversible, lined with hair-like spines in the distal half. Genital atrium narrow, unspined. Genital pore just or slightly posterior to caecal bifurcation.

Ovary three- or occasionally four-lobed, 0.31–1.41×0.11–0.22 as a whole, dextral to cirrus sac, between right cluster of vitellaria and partially overlapping right testis. Seminal receptacle absent and uterine seminal receptacle present. Laurer's canal slender, opening dorsally some distance posterior to acetabulum. Vitelline follicles in two lateral clusters, 8–10 on right and 7–9 on left, between levels of esophagus and ovary. Terminal organ 0.30–0.40×0.10–0.26, 51–91% length of cirrus sac, covered with glandular cells except proximal vesicle; proximal vesicle unspined; distal portion lined with hair-like spines and surrounded by large, muscular sphincter at distal end. Uterus filling almost posttesticular space and sinistral space of left testis and terminal organ; short metraterm entering into terminal organ just posterior to sphincter. Eggs 18–24×13–15 μm. Excretory vesicle Y-shaped, stem bifurcating nearer posterior extremity than acetabulum, arms may be short; pore terminal.

Remarks. Hafeezullah and Siddiqi (1970) described *Allobacciger macrorchis* as a new genus and species from *Scolopsis vosmeri* (Fam. Nemipteridae) from India. They stated that “seminal receptacle immediately postacetabular, dorsal to vitelline reservoir, largely obscured by voluminous uterus”, “uterus.....distal part dilated into sac filled with sperms, then terminating as short, highly muscular metraterm”, and placed *Allobacciger* in the family Fellodistomidae.

Our reexamination of their specimen (holotype, USNM Helm. Coll. No. 63213) revealed that a seminal receptacle is lacking, and a terminal organ present, that is, the uterus does not connect with a spherical sac, but the metraterm may be joined to the



Figs. 8–10. *Allobacciger centropygis* sp. nov. — 8. Entire worm, ventral view (NSMT-PI 3814, holotype). 9. Terminal genitalia, ventral view. 10. Ovarian complex, ventral view. A, acetabulum; C, cirrus sac; G, genital pore; I, seminal vesicle; L, Laurer's canal; M, Mehlis' gland; O, oviduct; P, prostatic cell; S, sphincter; T, vesicle of terminal organ; U, uterus; V, vitelline duct.

boundary between sac and muscular sphincter. The muscular sphincter and the cirrus seem to have fine spines. As indicated by Cribb *et al.* (1999), *Allobacciger* should be transferred from the Fellodistomidae to the Monorchiidae. *Allobacciger* is most like *Monorcheides*, but the latter has an elongated body, elliptical testes, testes and ovary lying in the hindbody. The vitellaria are situated at the acetabular level except *M. hafeezullahi* which has entirely preacetabular vitellaria (Bijukumar, 1997).

The present new species is similar to *Allobacciger macrorchis* in having an oval body, globular or ovoid testes at the acetabular level, and a trilobed ovary anterior to overlapping right testis, but differs in that *A. macrorchis* has small body 0.75 to 0.87 long by 0.44 to 0.59 wide, short caeca reaching testicular region, small cirrus sac 140 to 175 by 73 to 102 μm , and V-shaped excretory vesicle extending the level of prepharynx. We could not determine the extents of the caeca and the excretory vesicle in the holotype of *A. macrorchis*.

Family Lepocreadiidae
Lepotrema clavatum Ozaki, 1932

Material. From rectum of *Genicanthus semifasciatus*, Koniya, Kagoshima Prefecture, Japan, 20-XI-1985 (NSMT-PI 3216).

Remarks. Based on 4 specimens. Body 1.45–2.15 long by 0.67–0.95 wide. Cervical glands present. Oral sucker 0.12–0.17×0.16–0.25; prepharynx 0.10–0.15 long; pharynx 0.10–0.15×0.11–0.23; esophagus 0.05–0.12 long. Acetabulum 0.20–0.29×0.22–0.28. Sucker ratio 1:1.1–1.4. Forebody 44–47% of body length. Testes rather atrophic, 0.11–0.25×0.11–0.23. External seminal vesicle indistinct. Cirrus sac 0.45–0.60×0.12–0.14; cirrus everted and internal seminal vesicle without sperm. Ovary 0.17–0.19×0.19–0.26. Seminal receptacle indistinct. Vitellaria reaching esophageal or postpharyngeal level. Eggs 48–58×30–33 μ m.

This species was previously known from fishes of the Monacanthidae, Bothidae, Balistidae, Chaetodontidae and Pomacentridae from Japan, Hawaii and Great Barrier Reef (Bray & Cribb, 1996). This is the first record of *L. clavatum* from a pomacanthid fish.

Neopreptetos arusettae Machida, 1982

Material. From intestine of *Pomacanthus sexstriatus*, Nago, Okinawa Prefecture, Japan, 20-V-1983 (NSMT-PI 2783); and mid-intestine of *P. semicirculatus*, Nago, 20-V-1993 (NSMT-PI 4406).

Remarks. Based on 5 specimens. Body 2.75–3.28 long by 1.25–1.55 wide. Cervical glands present. Oral sucker 0.20–0.23×0.25–0.30; prepharynx up to 55 μ m long; pharynx 0.19–0.21×0.19–0.22; esophagus 0.13–0.26 long. Acetabulum 0.20–0.25×0.20–0.25. Sucker ratio 1:0.8–0.9. Forebody 39–44% of body length. Right testis 0.25–0.33×0.25–0.34 and left testis 0.28–0.36×0.31–0.35. Posttesticular space 24–30% of body length. Cirrus sac 0.68–0.98×0.27–0.33. Ovary 0.22–0.28×0.24–0.33. Eggs 57–65×35–45 μ m.

This species has hitherto been recorded from pomacanthid fishes from Palau, Japan and Great Barrier Reef (Bray & Cribb, 1966).

Family Hemiuridae
Duosphincter zancli Manter & Pritchard, 1960

Material. From stomach of *Pygoplites diacanthus*, Palau, western Caroline Islands, 29-VI-1980 (NSMT-PI 2380); stomach of *Pomacanthus xanthometopon*, Palau, 8-VII-1980 (NSMT-PI 2431); and stomach of *Pygoplites diacanthus*, Palau, 13-VII-1980 (NSMT-PI 2471).

Remarks. Based on 10 specimens. Body 0.84–1.07 long by 0.20–0.28 wide.

Oral sucker $0.09\text{--}0.13 \times 0.10\text{--}0.18$, mouth surrounded by sphincter; pharynx $33\text{--}49 \times 43\text{--}69 \mu\text{m}$. Acetabulum $0.09\text{--}0.16 \times 0.11\text{--}0.20$, aperture surrounded by sphincter. Sucker ratio 1 : 1.1–1.3. Forebody 32–41% of body length. Anterior testis $55\text{--}85 \times 78\text{--}140 \mu\text{m}$ and posterior testis $60\text{--}95 \times 90\text{--}148 \mu\text{m}$. Ovary $45\text{--}75 \times 85\text{--}145 \mu\text{m}$. Vitellaria composed of two compact masses, each mass $63\text{--}82 \times 70\text{--}126 \mu\text{m}$. Postvitelline space 18–29% of body length. Eggs $25\text{--}29 \times 15\text{--}17 \mu\text{m}$.

This species was previously known only from *Zanclus canescens* (Fam. Zanclidae) of Hawaii (Manter & Pritchard, 1960; Yamaguti, 1970).

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