

## Digenean Trematodes from Clupeid Fishes of the Genus *Amblygaster* of Japan and the Neighboring Waters

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**Abstract** Five species of digenean trematodes are described from clupeid fishes of the genus *Amblygaster* of Japan and the neighboring waters: *Bacciger amblygastris* sp. nov. (Faustulidae) from the lower intestine and rectum of *A. sirm* of the Philippines and the intestine of *A. leiogaster* of Japan; *Pronoprymna mijun* sp. nov. (Faustulidae) from the pyloric caeca of *A. leiogaster* of Japan; *Parahemiurus clupeae* Yamaguti, 1953 (Hemiuridae) from the stomach of *A. leiogaster* of Japan and *A. sirm* of the Philippines; *Parahemiurus merus* (Linton, 1910) (Hemiuridae) from the stomach of *A. leiogaster* of Indonesia; and *Aphanurus stossichi* (Monticelli, 1891) (Hemiuridae) from the stomach of *A. leiogaster* of Indonesia and Japan.

**Key words:** Faustulidae, Hemiuridae, Digenea, new species, clupeid fish, Japan, Philippines, Indonesia.

This paper deals with five species of digenean trematodes including two new species from clupeid fishes of the genus *Amblygaster* of Japan and the neighboring waters. The digeneans collected were washed in saline, fixed in AFA under slight pressure, stained with Heidenhain's hematoxylin and mounted in Canada 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 Faustulidae Poche, 1926

Genus *Bacciger* Nicoll, 1914

*Bacciger amblygastris* sp. nov.

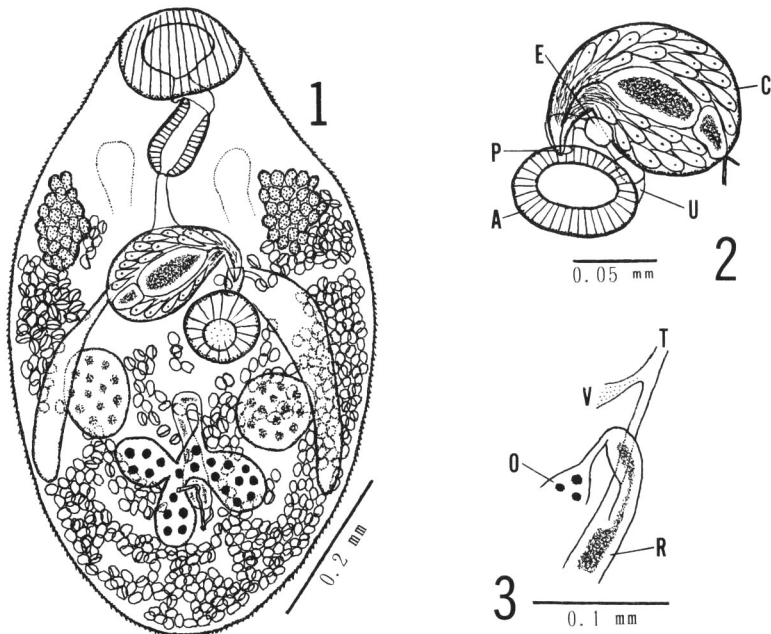
(Figs. 1–3)

**Material.** From lower intestine and rectum of *Amblygaster sirm*, Palawan, Philippines, 17–XI–1988 (NSMT-PI 3598, holotype & 7 paratypes) and intestine of *A. leiogaster*, Nago, Okinawa

Prefecture, Japan, 5–VI–1991 (NSMT-PI 4158, 3 paratypes).

**Description.** Eight specimens from *Amblygaster sirm*: Body small, oval, 0.60–0.85 long by 0.34–0.46 wide. Tegument with fine spines. Oral sucker subterminal, 0.08–0.13×0.14–0.17; prepharynx 7–46  $\mu$ m long; pharynx 0.08–0.11×0.05–0.07; esophagus 0.03–0.14 long, bifurcating in or near acetabular zone; caeca extending well beyond acetabulum to near midlevel of hindbody. Acetabulum 0.06–0.10×0.08–0.12. Sucker ratio 1:0.6–0.8. Forebody 37–50% of body length.

Gonads are often obscured by eggs. Testes ovoid, symmetrical, interior to or partially overlapping caeca, in anterior to central region of hindbody; right testis 0.08–0.14×0.06–0.12 and left testis 0.08–0.11×0.07–0.10. Posttesticular space 32–37% of body length. Cirrus sac pyriform with pointed distal end, 0.16–0.21×0.07–0.11, right, left of or sometimes overlapping acetabulum in part, extending posteriorly from mid-acetabular level to well posterior to acetabulum. Cirrus sac containing bipartite seminal vesicle, distal part of which two times or more longer than proximal part; pars prostatica with large



Figs. 1–3. *Bacciger amblygastris* sp. nov.—1. Entire worm, dorsal view (NSMT-PI 3598, holotype, beginning parts of caeca omitted). 2. Terminal genitalia, ventral view. 3. Ovarian complex, dorsal view. A, acetabulum; C, cirrus sac; E, egg; O, ovary; P, genital pore; R, seminal receptacle; T, ootype; U, uterus; V, vitelline reservoir.

prostatic cells; and short cirrus. Distal point of cirrus sac projecting into small genital atrium. Genital pore median, at anterior border of acetabulum.

Ovary trilobed,  $0.10\text{--}0.17 \times 0.09\text{--}0.19$  as a whole, median, completely or partially posttesticular. Oviduct arising from anterior conical projection of ovary, descending to enter longitudinally elongated seminal receptacle ( $0.13\text{--}0.17 \times 0.04\text{--}0.09$  in 3 specimens), leaving seminal receptacle at the anterior to middle level, and ascending to receive vitelline reservoir. Laurer's canal originating from posterior end of seminal receptacle, sinuous, opening dorsally at mid- to postovarian level. Vitellaria in two lateral groups of a mass of small follicles each, in esophageal and sometimes acetabular zone. Uterus extensive, filling most of hindbody and lateral to cirrus sac. Metraterm indistinct. Distal end of uterus joining near base of genital atrium. Eggs  $20\text{--}22 \times 16\text{--}17 \mu\text{m}$ . Excretory vesicle V-shaped, arms extending to pharyngeal level; pore terminal.

Three specimens from *Amblygaster leiogaster* are slightly larger than aforementioned specimens. Body  $1.11\text{--}1.23 \times 0.57\text{--}0.67$ . Oral sucker  $0.09\text{--}0.13 \times 0.15\text{--}0.19$ . Prepharynx  $17\text{--}38 \mu\text{m}$  long. Pharynx  $0.12\text{--}0.14 \times 0.07\text{--}0.10$ . Esophagus  $0.12\text{--}0.14$  long. Acetabulum  $0.08\text{--}0.12 \times 0.09\text{--}0.13$ . Sucker ratio  $1:0.5\text{--}0.7$ . Forebody  $36\text{--}46\%$  of body length. Right testis  $0.17\text{--}0.18 \times 0.11\text{--}0.15$  and left testis  $0.11\text{--}0.18 \times 0.15\text{--}0.16$ . Posttesticular space  $34\text{--}41\%$  of body length. Cirrus sac  $0.25\text{--}0.34 \times 0.17\text{--}0.19$ . Ovary  $0.17\text{--}0.22 \times 0.22\text{--}0.32$  as a whole. Eggs  $22\text{--}24 \times 15\text{--}16 \mu\text{m}$ .

*Remarks.* Bray and Gibson (1980) considered four species of *Bacciger* to be probably valid: *Bacciger bacciger* (Rudolphi, 1819), *B. ovatus* (Price, 1934), *B. cochinesis* Hafeezullah & Siddiqi, 1970 and *B. grandispinatus* Naidenova, 1970. Manna and Datta (1996) erected the genus *Baccigeroides* and transferred *Bacciger cochinesis* to *Baccigeroides* chiefly because of the internal seminal vesicle being unipartite. Subsequent to Bray and Gibson (1980), six

species have been described: *Bacciger israelensis* Fischthal, 1980, *B. leptobotiae* Wang, 1981 (cited from Zhang *et al.*, 1999), *B. lesteri* Bray, 1982, *B. sprengi* Bray, 1982, *B. pellowae* Thatcher, 1992 and *B. astyanactis* Lunaschi, 1998. In addition, two species of *Bacciger*, *B. mugilis* Shen, 1987 and *B. lizae* Shen, 1995, are reported from China. In both species, the vitelline follicles are scattered in the lateral fields of the hindbody. It is doubtful whether they are members of *Bacciger*.

Of them, the present new species is most like *B. ovatus* in having long caeca which extend well beyond the acetabulum to near the midlevel of the hindbody, but differs from it in the genital pore lying median, at the anterior border of the acetabulum instead of submedian, at the posterior end of the pharynx. The ovary in *B. ovatus* is illustrated as being slightly irregular and non-lobed in the original paper by Price (1934), but in the present species it is distinctly trilobed.

Genus *Pronoprymna* Poche, 1926

*Pronoprymna mijun* sp. nov.

(Figs. 4–6)

*Material.* From pyloric caeca of *Amblygaster leiogaster*, Nago, Okinawa Prefecture, Japan, 2–XII–1996 (NSMT-PI 4991, holotype & 9 paratypes).

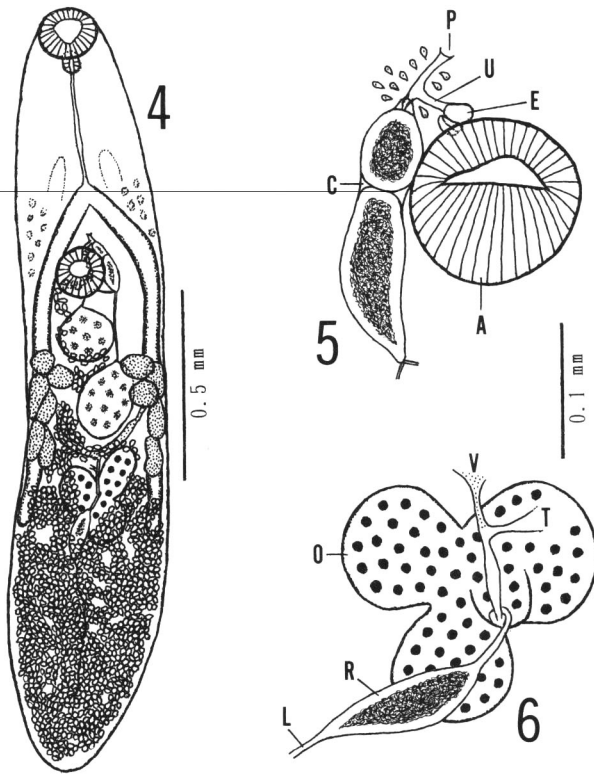
*Description.* Based on 10 slightly macerated specimens. Body lanceolate, 1.32–1.93 long by 0.39–0.50 wide. Tegument smooth. Cervical glands present. Oral sucker subterminal, 0.11–0.15×0.13–0.18; prepharynx very short, 15 μm long; pharynx subglobular, 0.04–0.07×0.04–0.05; esophagus 0.09–0.32 long, bifurcating nearer acetabulum than pharynx; caeca passing dorsal to vitellaria, to terminate at ovarian level, near midlevel of hindbody. Acetabulum 0.10–0.16×0.12–0.16. Sucker ratio 1:0.7–1.1. Forebody 30–39% of body length.

Testes spherical to ovoid, almost tandem or diagonal, usually contiguous; anterior testis 0.14–0.20×0.14–0.21, just posterior to or partially overlapping acetabulum; posterior testis 0.15–0.21×0.14–0.22. Posttesticular space 40–52% of

body length. Cirrus sac elongated, 0.11–0.20×0.05–0.07, thin-walled, adhering closely to seminal vesicle, lying right, left, or dorsal to acetabulum, and extending posteriorly from mid-acetabular level to slightly posterior to acetabulum. Internal seminal vesicle bipartite, the posterior part of which is larger. Pars prostatica and cirrus not observed. Very small ejaculatory duct and short, narrow genital atrium recognized in the expanded specimens. A few gland cells scattered around distal end of cirrus sac and genital atrium. Genital pore median or slightly submedian, midway between caecal bifurcation and acetabulum.

Ovary median, trilobed, 0.18–0.25×0.18–0.28 as a whole, touching or slightly separated from posterior testis. Postovarian space 25–38% of body length. Oviduct arising from cylindrical projection in the mid-region 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 swollen to form elongated seminal receptacle (0.14–0.16×0.04–0.05 in 3 specimens) which lies near or sometimes overlapping posterior portion of ovary. Laurer's canal originating from posterior end of seminal receptacle, descending, slightly sinuous, and opening dorsally 0.19–0.23 (in 2 specimens) anterior to posterior end of body. Vitellaria in two lateral groups, each composed of 5–7 relatively large follicles, ventral to caeca, located some distance posterior to acetabulum, between midlevel of anterior testis and midovarian level. Each vitelline duct running inward along posterior edge of rear testis and joining in anterior region of ovary. Uterus extensive, filling most of posttesticular space and extending sinuously to anterior border of acetabulum before entering base of genital atrium. Eggs 22–25×17–19 μm. Excretory vesicle V- or Y-shaped with extremely short stem, arms extending to esophageal level; pore terminal.

*Remarks.* We place the present new species in the genus *Pronoprymna* because it possesses smooth tegument; thin-walled cirrus sac, adhering closely to the surface of a bipartite seminal vesicle; and a trilobed ovary lying in the midline,



Figs. 4–6. *Pronoprymna mijun* sp. nov.—4. Entire worm, ventral view (NSMT-PI 4991, holotype). 5. Terminal genitalia, ventral view. 6. Ovarian complex, ventral view. A, acetabulum; C, cirrus sac; E, egg; L, Laurer's canal; O, ovary; P, genital pore; R, seminal receptacle; T, ootype; U, uterus; V, vitelline reservoir.

immediately posttesticular. However, the present species differs from other members of the genus in having diagonal or almost tandem testes; and the vitellaria composed of 5 to 7 relatively large follicles on each side, lying some distance posterior to acetabulum, between midlevel of the anterior testis and the midovarian level. In all others in *Pronoprymna*, the testes are arranged symmetrically, and the vitellaria consist of two symmetrical masses of tightly packed follicles, lying lateral or postero-lateral to the acetabulum.

We prefer to broaden the concept of the genus *Pronoprymna* by Bray and Gibson (1980) to include these characters. The name *mijun* is from the Japanese local name of the host.

#### Genus *Pronoprymna* emended

Body small, fusiform to elongate. Tegument

smooth. Testes globular to irregularly oval; symmetrical, diagonal, or tandem in anterior half of hindbody. Cirrus sac elongated, thin-walled; closely attached to surface of seminal vesicle. Seminal vesicle internal, bipartite. Pars prostatica short or indistinct, surrounded by a few external gland cells. Ejaculatory duct short or practically absent. Cirrus absent. Genital pore just anterior to acetabulum. Ovary median, posttesticular, trilobed. Seminal receptacle present. Laurer's canal opening dorsally close to posterior extremity. Uterus filling most of hindbody. Vitellaria in two lateral groups, each composed of a mass of tightly packed follicles or a cluster of follicles; lateral, postero-lateral, or well posterior to acetabulum. Excretory vesicle V- or Y-shaped with extremely short stem; arms reaching into forebody to esophageal level.

Family Hemiuridae Looss, 1899

Genus *Parahemiurus* Vaz & Pereira, 1930

***Parahemiurus clupeae*** Yamaguti, 1953

*Material.* From stomach of *Amblygaster leiogaster*, Ishigaki-jima, Okinawa Prefecture, Japan, 26-II-1973 (NSMT-PI 5410); stomach of *A. sirm*, Palawan, Philippines, 17-XI-1988 (NSMT-PI 3599); stomach of *A. leiogaster*, Nago, Okinawa Prefecture, 5-VI-1991 (NSMT-PI 4159); and stomach of *A. leiogaster*, Nago, 22-V-1992 (NSMT-PI 4276).

*Description.* Based on 10 specimens. Body 2.78–6.00 in total length by 0.44–0.78 wide. Ecsoma well-developed, entirely projecting, not withdrawn into soma, 0.75–3.50 long, 25–58% of body length. Plications reaching to posterior margin of soma. Oral sucker 0.13–0.20×0.17–0.26. Pharynx 0.09–0.14×0.09–0.13. Acetabulum 0.22–0.51×0.24–0.54. Sucker ratio usually 1:1.3–1.6, but 1:2.5 in one specimen. Anterior testis 0.15–0.31×0.22–0.37 and posterior testis 0.15–0.34×0.24–0.42. Seminal vesicle 0.21–0.50×0.15–0.27, 0.14–0.33 separated from acetabulum. Hermaphroditic sac 0.14–0.33×0.04–0.08. Ovary 0.14–0.23×0.19–0.36, 0.06–0.70 separated from posterior margin of soma. Vitellaria ovoid, usually with smooth surface, occasionally with one to three shallow incisions; right vitellarium 0.16–0.29×0.12–0.29 and left vitellarium 0.16–0.26×0.16–0.31. Eggs 16–20×8–11 μm.

*Remarks.* According to Bray (1990), this species is distinguishable by the plications throughout the surface of the soma, the small eggs (18–21 μm long) and the relatively small acetabulum (sucker ratio 1:1.29–1.37). In addition, our specimen has a well-developed ecsoma, entirely projecting from the soma.

This species was first found by Yamaguti (1953) from *Clupea clupeioides* (= *Amblygaster c.*) of Sulawesi, Indonesia. There appears to be no records of this species afterward. Our present survey proved *Parahemiurus clupeae* to have a wide distribution in the West Pacific, from Indonesia to southern Japan through the Philip-

***Parahemiurus merus*** (Linton, 1910)

*Material.* From stomach of *Amblygaster leiogaster*, Lombok, Indonesia, 22-I-1994 (NSMT-PI 5180a).

*Description.* Based on 5 specimens. Body proper (soma) 1.57–2.20 long by 0.53–0.64 wide. Ecsoma 0.39–0.55 long, mostly withdrawn into soma. Plications extending from anterior extremity to ovarian level, not reaching to posterior margin of soma. Oral sucker 0.06–0.09×0.08–0.11. Pharynx 0.04–0.06×0.05–0.07. Acetabulum 0.16–0.21×0.20–0.25. Sucker ratio 1:2.2–2.5. Anterior testis 0.10–0.12×0.17–0.26 and posterior testis 0.10–0.14×0.18–0.23. Seminal vesicle 0.16–0.29×0.13–0.22. Hermaphroditic sac 0.12–0.24×0.03–0.04. Ovary 0.08–0.13×0.19–0.27, 0.50–0.93 separated from posterior margin of soma. Vitellaria ovoid, usually with smooth surface, occasionally with one or two shallow incisions; right vitellarium 0.13–0.19×0.14–0.23 and left vitellarium 0.14–0.24×0.18–0.21. Eggs 23–26×11–14 μm.

*Remarks.* This species is distinguished from aforementioned *Parahemiurus clupeae* by the plications not reaching the posterior margin of the soma, the large eggs (23–26 μm long), and the relatively large acetabulum (sucker ratio 1:2.2–2.5). In addition, the ecsoma is mostly withdrawn into the soma in our specimens.

Bray (1990) reduced *Parahemiurus parahemiurus* Vaz & Pereira, 1930, *P. sardiniae* Yamaguti, 1934, *P. seriolae* Yamaguti, 1934, *P. platichthyi* Lloyd, 1938, *P. atherinae* Yamaguti, 1938, *P. harengulae* Yamaguti, 1938 and *P. noblei* King, 1962 to synonymy with *P. merus*. Bray (1990) also gave information about hosts and distribution of *P. merus*.

Genus *Aphanurus* Looss, 1907

***Aphanurus stossichi*** (Monticelli, 1891)

*Material.* From stomach of *Amblygaster leiogaster*, Lombok, Indonesia, 22-I-1994 (NSMT-PI 5180b) and stomach of *A. leiogaster*, Nago, Okinawa Prefecture, Japan, 2-XII-1996 (NSMT-PI 4992).

*Description.* Based on 7 specimens. Body 1.10–1.75 long by 0.33–0.45 wide. Plications throughout body surface. Oral sucker 0.05–0.07×0.08–0.09. Pharynx 0.03–0.05×0.04–0.05. Acetabulum 0.10–0.21×0.16–0.20. Sucker ratio 1:2.0–2.5. Forebody 16–24% of body length. Right testis 0.06–0.15×0.10–0.20 and left testis 0.06–0.19×0.12–0.27. Seminal vesicle 0.08–0.18×0.06–0.14. Hermaphroditic sac 0.08–0.12×0.03–0.05. Ovary 0.09–0.13×0.15–0.23. Postovarian space 35–44% of body length. Vitellarium 0.12–0.18×0.17–0.29. Eggs 19–23×10–12  $\mu\text{m}$ .

*Remarks.* Yamaguti (1938) described *Aphanurus harengulae* as a new species from *Harengula zunasi* (= *Sardinella z.*) of Japan, differing from *A. stossichi* in egg size. However, the eggs of *A. harengulae*, 18 to 22 by 11 to 12  $\mu\text{m}$ , overlap those of *A. stossichi*, 21 to 27 by 11 to 15  $\mu\text{m}$ . We agree with Skrjabin and Guschanskaja (1958) that *A. harengulae* is a synonym of *A. stossichi*.

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