

Digenean Trematodes from Mulletts in Japanese and Adjacent Waters

MASAAKI MACHIDA

Department of Zoology, National Science Museum,
3-23-1 Hyakunincho, Shinjuku-ku, Tokyo 169, Japan.
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Abstract

Eight species of digenean trematodes of the families Waretrematidae, Haploporidae, Haplospalchnidae and Hemiuridae are reported from mulletts in Japanese and adjacent waters. *Waretrema piscicolum* Srivastava, 1939 (Waretrematidae) and *Hymenocotta mulli* Manter, 1961 (Haplospalchnidae) are newly recorded from Japanese waters. Six new species are described: *Carassotrema philippinense* sp. nov. (Waretrematidae) from the intestine of *Mugil cephalus* in Philippine waters, *Dicrogaster japonica* sp. nov. (Haploporidae) from the intestine of *Mugil cephalus* in Japanese waters, *Haploporus spinosus* sp. nov. (Haploporidae) from the intestine of *Crenimugil crenilabis* in Japanese waters, *Haploporus magnisaccus* sp. nov. (Haploporidae) from the intestine of *Crenimugil crenilabis* and *Mugil cephalus*(?) in Japanese and Indonesian waters, *Lecithobotrys stomachicola* sp. nov. (Haploporidae) from the gastric cardia of *Crenimugil crenilabis* and *Mugil cephalus*(?) in Japanese and Indonesian waters, and *Hysterolecitha indonesiana* sp. nov. (Hemiuridae) from the stomach of *Mugil cephalus*(?) in Indonesian waters. *L. stomachicola* has various shapes of caecum, from double to single.

Key words: digeneans; Waretrematidae; Haploporidae; Haplospalchnidae; Hemiuridae; mulletts.

Introduction

Descriptions of digenean trematodes from unicornfishes (Machida and Uchida, 1990) and kyphosid fishes (Machida, 1980, 1993) have been made from Japanese and adjacent waters. This report deals with eight species of digenean trematodes, including six new ones, of the families Waretrematidae, Haploporidae, Haplospalchnidae and Hemiuridae from mulletts from the same waters.

Materials and Methods

Digeneans were collected from fresh mulletts, 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 oth-

erwise stated.

Family Waretrematidae

Waretrema piscicolum Srivastava, 1939 (Fig. 1)

Material examined. One specimen from intestine of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 26-I-1990 (NSMT-P1 3841); 7 specimens from intestine of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 27-IX-1994 (4700); 1 specimen from intestine of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 29-IX-1994 (4705); and 1 specimen from intestine of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 4-X-1994 (4731).

Description. Based on 10 specimens. Body fusiform to cylindrical, 2.3–4.6 long by 0.84–1.23 wide, usually widest at midbody. Tegument smooth. Oral sucker funnel-shaped, 0.26–0.39 × 0.33–0.44, divided anteriorly into six conical projections; two larger dorsolateral, two lateral and two ventrolateral. Prepharynx 0.11–0.43 long. Pharynx pot-shaped, 0.23–0.28 × 0.19–0.27. Esophagus 0.15–

〒丁田昌昭 (国立科学博物館動物研究部)

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0.62 long, bifurcating near postacetabular level. Caeca extending to middle to posterior third of hindbody. Acetabulum weakly developed, spherical or slightly wider than long, $0.26\text{--}0.47 \times 0.37\text{--}0.52$. Sucker ratio 1:1.1–1.5. Forebody 28–37% of body length.

Testis single, longitudinally elongated, $0.62\text{--}1.38 \times 0.31\text{--}0.43$, in posterior half of hindbody, almost to posterior end of body. Two vasa efferentia arising from anterior end of testis and running forward without unite with each other. External seminal vesicle elongated, $0.74\text{--}1.25 \times 0.10\text{--}0.20$, terminating posteriorly to near ovary. Hermaphroditic sac club-shaped, $0.41\text{--}0.70 \times 0.17\text{--}0.33$, extending posteriorly to near postacetabular level; contents including oval to elongated internal seminal vesicle $0.32\text{--}0.51$ long, with its anterior portion turning posteriorly, small prostatic vesicle, female duct $0.07\text{--}0.25$ long, and eversible hermaphroditic duct $0.30\text{--}0.54$ long. Genital pore median, in zone of pharynx or a little more posteriorly.

Ovary ovoid, $0.19\text{--}0.33 \times 0.15\text{--}0.29$, situated in 56–67% of body length from anterior extremity, anterior to or occasionally in contact with testis. Seminal receptacle absent. Proximal portion of uterus filled with sperm. Laurer's canal usually opening dorsal to anterior portion of testis. Vitellaria tubular in the posterior half and irregular-shaped in the anterior half, extending from ovarian zone to posterior end of body. Uterus preovarian, intercaecal or occasionally overlapping caeca. Eggs thin-shelled, $64\text{--}73 \times 41\text{--}49 \mu\text{m}$, without miracidia.

Remarks. This species was initially described by Srivastava (1939) based on the material from *Mugil waigiensis* of Karachi, and later Velasquez (1961) found it from *Scatophagus argus* of the Philippines. My specimens agree with their descriptions in general features except as follows: 1) In my specimens, the testis is more elongated, extending to near the posterior end of the body. 2) There is no evidence of a seminal receptacle. Srivastava and Velasquez described and illustrated a seminal receptacle far away from the ovary. They may take a uterine seminal receptacle for it. 3) The vitellaria are not necessarily tubular. In my specimens, some are tubular and the others irregular-shaped.

Carassotrema philippinense sp. nov.

(Fig. 2)

Material examined. Six specimens from intestine of *Mugil cephalus*, Mactan, Philippines, 25-X-1988 (NSMT-P1 3525, holotype and 5 paratypes) and 2 specimens from intestine of *Mugil cephalus*, Palawan, Philippines, 19-VIII-1990 (3939, paratypes).

Description. Based on 8 specimens. Body oval, 1.11–1.94 long by 0.60–0.85 wide. Tegument spinose from anterior end to postacetabular level. Oral sucker subglobular, subterminal, $0.11\text{--}0.16 \times 0.17\text{--}0.21$; prepharynx 0.05–0.18 long; pharynx pot-shaped, well-developed, $0.18\text{--}0.23 \times 0.18\text{--}0.26$; esophagus 0.12–0.31 long, bifurcating at mid- to postacetabular level; caeca short, extending anterior end of posterior third of hindbody. Caeca filled with foamy substance. Acetabulum weakly developed, somewhat wider than long, $0.24\text{--}0.34 \times 0.31\text{--}0.41$. Sucker ratio 1:1.6–2.1. Forebody 34–42% of body length.

Testis single, ovoid to elongated, $0.24\text{--}0.84 \times 0.15\text{--}0.25$, lying longitudinally or obliquely in posterior half of hindbody. Two vasa efferentia arising from anterior end of testis. External seminal vesicle tubular, midway between acetabulum and ovary in posterior extent. Hermaphroditic sac ovoid to claviform, slightly arcuate, $0.28\text{--}0.49 \times 0.11\text{--}0.20$, reaching near postacetabular level, containing tubular or saccular internal seminal vesicle $0.18\text{--}0.33$ long, small prostatic vesicle, female duct $0.07\text{--}0.18$ long, and eversible hermaphroditic duct $0.18\text{--}0.33$ long. Genital pore median or submedian, anterior to acetabulum, usually in pharyngeal zone.

Ovary globular or subglobular, $0.10\text{--}0.15 \times 0.09\text{--}0.23$, immediately anterior to testis. Seminal receptacle absent. Proximal end of uterus filled with sperm. Laurer's canal opening dorsally a short distance posterior to ovary. Vitellaria follicular, extending from postbifurcal level to posterior end of body, dorsal to gonads and caeca. Uterus preovarian. Eggs thin-shelled, $61\text{--}70 \times 41\text{--}47 \mu\text{m}$, without miracidia. Excretory vesicle extending to ovarian zone; pore terminal.

Remarks. Nine species of the genus *Carassotrema* have been recorded from eastern Asia, of them three species have oral bodies like the present species, that is, *C. kui* Tang et Lim, 1963, *C. megapharyngus*

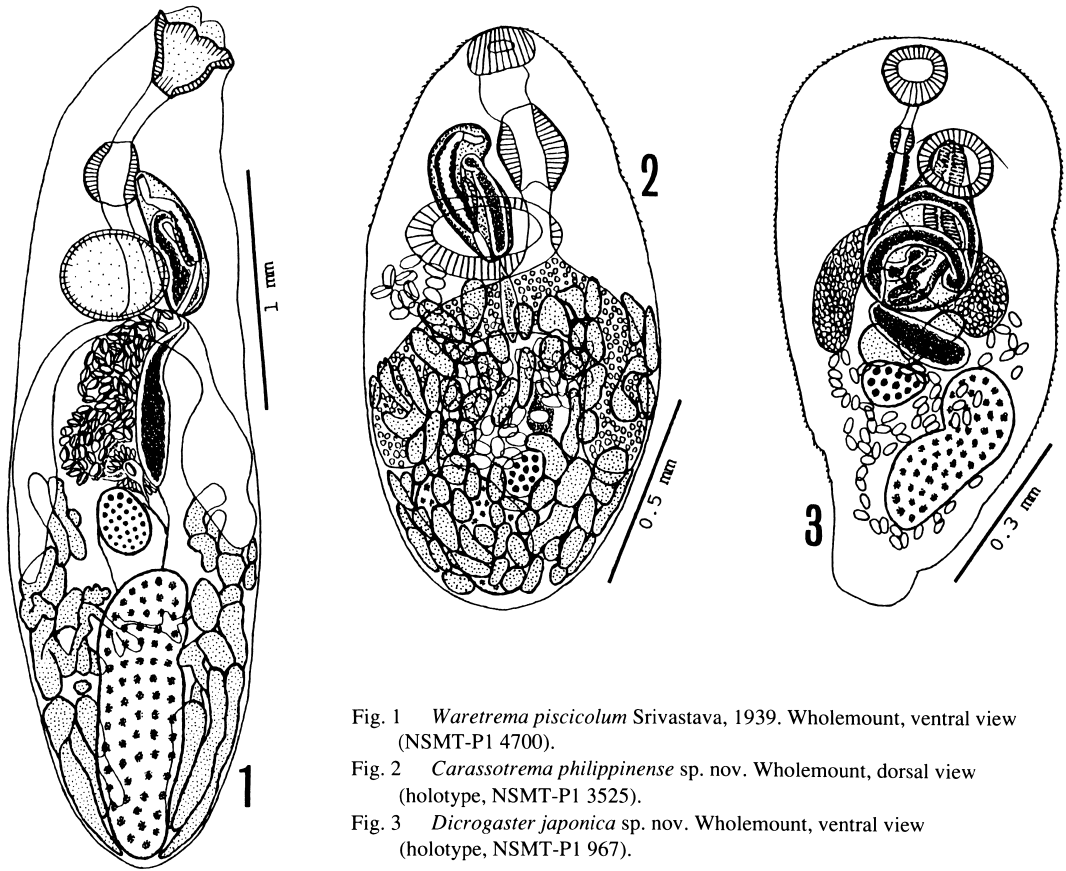


Fig. 1 *Waretrema piscicolum* Srivastava, 1939. Wholemount, ventral view (NSMT-P1 4700).

Fig. 2 *Carassotrema philippinense* sp. nov. Wholemount, dorsal view (holotype, NSMT-P1 3525).

Fig. 3 *Dicrogaster japonica* sp. nov. Wholemount, ventral view (holotype, NSMT-P1 967).

Wang, 1964 and *C. heterorchis* Wang (the date of publication is unknown; cited from "Fauna of Zhejiang"). The present species is most similar to *C. megapharyngus* in having a strongly developed pharynx and a testis that is not triangular or V-shaped. However, differences are observed in that the latter species has an acetabulum as large as the oral sucker, no prepharynx, caeca reaching near the posterior end of the body, and a genital pore anterior to the acetabulum, between pharynx and acetabulum.

Family Haploporidae

Dicrogaster japonica sp. nov.

(Fig. 3)

Material examined. Ten specimens from intestine of *Mugil cephalus*, Fukaura, Ehime Prefecture,

Japan, 21-V-1972 (NSMT-P1 967, holotype and 9 paratypes).

Description. Based on 10 specimens. Body inverted pyriform, 0.75–1.02 long by 0.35–0.51 wide. Tegument spinose. Oral sucker spherical, subterminal, 0.07–0.11 × 0.09–0.15; prepharynx 0.02–0.05 long; pharynx globular or subglobular, 0.04–0.06 × 0.04–0.06; esophagus 0.09–0.20 long, covered with glandular cells; intestinal bifurcation postacetabular level or occasionally mid- or preacetabular level; caeca short, saccular, filled with foamy substance, extending to near midlevel of hindbody. Acetabulum spherical or almost spherical, 0.08–0.13 × 0.11–0.15. Sucker ratio 1:0.9–1.3. Forebody 19–30% of body length.

Testis single, elongated, 0.25–0.40 × 0.13–0.27, in middle or posterior half of hindbody. Posttesticular space 5–25% of body length. External seminal vesicle

cle tubular to saccular, varying in size depending on the volume of sperm, $0.08\text{--}0.22 \times 0.03\text{--}0.04$, between hermaphroditic sac and testis. Hermaphroditic sac large, conical, $0.18\text{--}0.31 \times 0.15\text{--}0.25$, dorsal to acetabulum, containing convoluted tubular seminal vesicle which usually forming a ring, small prostatic vesicle, female duct, and hermaphroditic duct $0.14\text{--}0.26$ long, lined with fusiform cells. Genital pore median, just anterior to acetabulum.

Ovary ovoid, $0.07\text{--}0.14 \times 0.09\text{--}0.13$, anterior or obliquely anterior to and almost always in contact with testis. Seminal receptacle absent. Proximal end of uterus filled with sperm. Laurer's canal running backward and opening dorsally near midlevel of testis. Vitellaria consisting of two compact masses tightly together or taking the shape of dumbbell, in zone of ovary and sometimes overlapping ovary in part. Uterus filled most of posterior spaces of hermaphroditic sac, reaching near posterior end of body. Eggs $43\text{--}53 \times 21\text{--}26 \mu\text{m}$, some of them contain miracidia. Excretory vesicle Y-shaped; stem extending to near ovary; pore terminal.

Remarks. The genus *Dicrogaster* contains four species: *D. perpusilla* Looss, 1902, *D. contracta* Looss, 1902, *D. fastigata* Thatcher et Sparks, 1958 and *D. fragilis* Bargiela, 1987.

In the former two species, the vitellaria were so close together as to appear like a single mass of three or four masses (Looss, 1902). Fares and Maillard (1974), however, showed the vitellaria of *D. contracta* to be two lobed masses. Consequently the only difference between *D. contracta* and the members of the genus *Haploporus* is the shape of caecum, saccular or cylindrical. In the latter two species, the vitellaria were composed of a single lobe (Thatcher and Sparks, 1958; Overstreet, 1971; Bargiela, 1987). The present new species resembles *D. contracta* in having vitellaria composed of two compact masses, but differs from it in having a long tubular internal seminal vesicle which forms a ring in the hermaphroditic sac.

***Haploporus spinosus* sp. nov.**

(Figs. 4 and 5)

Material examined. Five specimens from intestine of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 5-VI-1991 (NSMT-P1 4162, holotype

and 4 paratypes); 1 specimen from intestine of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 14-V-1993 (4365, paratype) and 4 specimens from intestine of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 30-IX-1994 (4709, paratypes).

Description. Based on 10 specimens. Body slender, $1.43\text{--}3.04$ long by $0.31\text{--}0.51$ wide at acetabular level. Tegument spinose from anterior end to near caecal termination. Oral sucker almost rounded, subterminal, $0.05\text{--}0.13 \times 0.09\text{--}0.17$; prepharynx $0.01\text{--}0.05$ long; pharynx globular, $0.05\text{--}0.10 \times 0.05\text{--}0.11$; esophagus $0.34\text{--}0.74$ long, bifurcating a short distance posterior to acetabulum; caeca terminating in ovarian zone. Acetabulum weakly developed, rounded, $0.10\text{--}0.16 \times 0.12\text{--}0.18$. Sucker ratio 1:1.0–1.4. Forebody 17–30% of body length.

Testis single, elongated, $0.23\text{--}0.53 \times 0.07\text{--}0.15$, in posterior half of hindbody. Posttesticular space 6–20% of body length. Two vasa efferentia arising from anterior end of testis and running forward without forming a vas deferens. External seminal vesicle saccular to elongated, $0.16\text{--}0.40$ long, extending posteriorly to a level between acetabulum and ovary. Hermaphroditic sac usually arcuate, $0.39\text{--}0.57 \times 0.12\text{--}0.22$, posterior extent from midacetabular level to midway between acetabulum and ovary, containing oval internal seminal vesicle $0.13\text{--}0.32$ long, small prostatic vesicle, female duct $0.09\text{--}0.25$ long and hermaphroditic duct. Circular muscles developed between female and hermaphroditic ducts. Hermaphroditic duct 1/2 or more the length of hermaphroditic sac, and having anteriorly four slender spines $0.12\text{--}0.16$ long. Each spine with two knobs at the base where sticks thin musculature connecting with the edge of genital pore. Genital pore median, immediately anterior to acetabulum, provided interiorly with six short spines 0.05 long. These spines also having two knobs at the base.

Ovary rounded, $0.09\text{--}0.20 \times 0.10\text{--}0.18$, middle of hindbody, anterior to and sometimes in contact with testis. Seminal receptacle lacking and uterine seminal receptacle present. Laurer's canal opening dorsally in anterior portion of testis. Vitellaria two compact masses, slightly smaller than ovary, immediately postovarian. Uterus extending to posterior end of body. Eggs thin-shelled, $34\text{--}42 \times 18\text{--}23 \mu\text{m}$. Miracidial eyespots present in eggs of distal portion

of uterus. Excretory vesicle short, saccate; pore terminal.

Remarks. According to Rekharani and Madhavi (1985), the genus *Haploporus* contains five species, all from the mugilid fishes: *H. benedeni* (Stossich, 1887), *H. lateralis* Looss, 1902, *H. longicollum* (Wlassenko, 1931), *H. indicus* Rekharani et Madhavi, 1985 and *H. pseudoindicus* Rekharani et Madhavi, 1985. Of them, *H. lateralis* may possibly be a synonym of *H. benedeni* (Fares and Maillard, 1974) and *H. longicollum* is uncertain whether it belongs to *Haploporus* because of the long prepharynx and

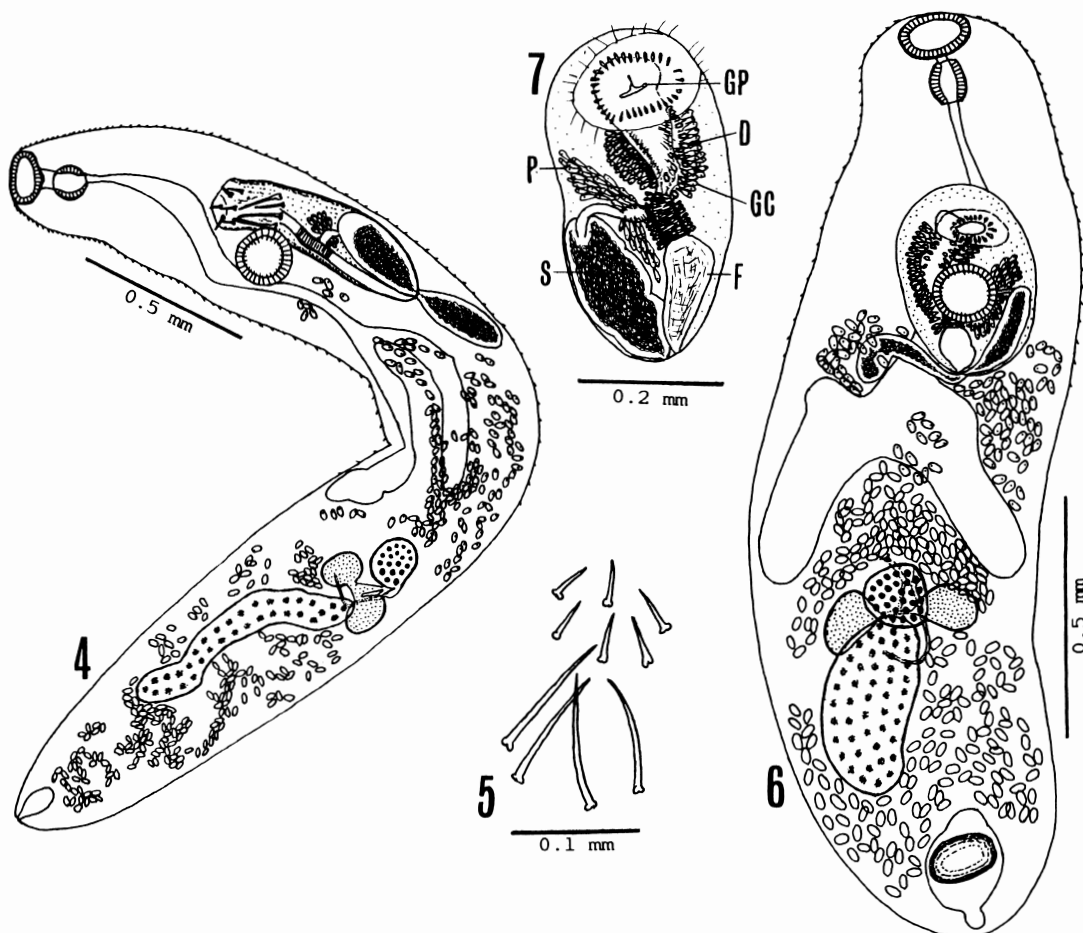
the ovary and vitellaria posterior to the caecal ends (Overstreet, 1982).

The present new species differs from them by the caecal bifurcation posterior to the acetabulum, and the hermaphroditic duct armed with four long and six short spines.

***Haploporus magnisaccus* sp. nov.**

(Figs. 6 and 7)

Material examined. Five specimens from intestine of *Crenimugil crenilabis*, Nago, Okinawa Pre-



Figs. 4 and 5 *Haploporus spinosus* sp. nov. 4. Wholemount, ventral view (holotype, NSMT-P1 4162). 5. Spines attached to hermaphroditic duct.

Figs. 6 and 7 *Haploporus magnisaccus* sp. nov. 6. Wholemount, ventral view (holotype, NSMT-P1 4290). 7. Hermaphroditic sac, ventral view. D, diverticulum; F, female duct; GC, glandular cell; GP, genital pore; P, prostatic cell; S, internal seminal vesicle.

fecture, Japan, 26-V-1992 (NSMT-P1 4290, holotype and 4 paratypes) and 1 specimen from intestine of *Mugil cephalus*(?), Ambon, Indonesia, 23-I-1993 (4317, paratype).

Description. Based on 6 specimens. Body elliptical, 1.9–2.5 long by 0.58–0.68 wide at acetabular level. Tegument with fine spines from anterior end to intestinal bifurcation. Oral sucker rounded, subterminal, 0.08–0.11 × 0.13–0.18; prepharynx up to 0.06 long; pharynx ovoid, 0.08–0.10 × 0.07–0.10; esophagus long, up to 0.90 long. Intestinal bifurcation a short or some distance posterior to acetabulum; caeca short and broad, extending to near ovary. Acetabulum weakly developed, spherical, 0.14–0.15 × 0.14–0.17. Sucker ratio 1:0.9–1.2. Forebody 22–35% of body length.

Testis single, elliptical, 0.34–0.64 × 0.20–0.27. Posttesticular space 16–21% of body length. Hermaphroditic sac thin-walled, voluminous, 0.40–0.48 × 0.24–0.29, extending dorsal of acetabulum to some distance posterior to it; containing ovoid internal seminal vesicle 0.19–0.37 long, small prostatic vesicle with prostatic cells, female duct 0.09–0.14 long, and hermaphroditic duct 0.15–0.25 long. Circular muscles and glandular cells conspicuous between female and hermaphroditic ducts. Hermaphroditic duct surrounded by tall, thin-walled glandular cells and about 100 short, thick-walled diverticula which are enclosed by longitudinal muscle bundles. Genital pore some distance anterior to acetabulum, with a circle of nearly 40 diverticula. External seminal vesicle subcylindrical, 0.13–0.28 long, midway between acetabulum and ovary in posterior extent.

Ovary subglobular, 0.11–0.15 × 0.14–0.20, in contact with anterior border of testis. Seminal receptacle lacking and proximal end of uterus containing sperm. Laurer's canal opening dorsally near midlevel of testis. Vitellaria two compact masses, just postovarian. Uterus reaching near posterior end of body. Eggs thin-shelled, 34–42 × 18–26 μm, with developed oculate miracidia. Excretory vesicle short, saccate, consistently with single concretion 0.15–0.20 × 0.07–0.12; pore terminal.

Remarks. The present new species resembles the above mentioned *H. spinosus* in the intestinal bifurcation posterior to the acetabulum, but differs from it in the hermaphroditic duct with short, thick-

walled diverticula instead of four long and six short spines.

***Lecithobotrys stomachicola* sp. nov.**

(Figs. 8–13)

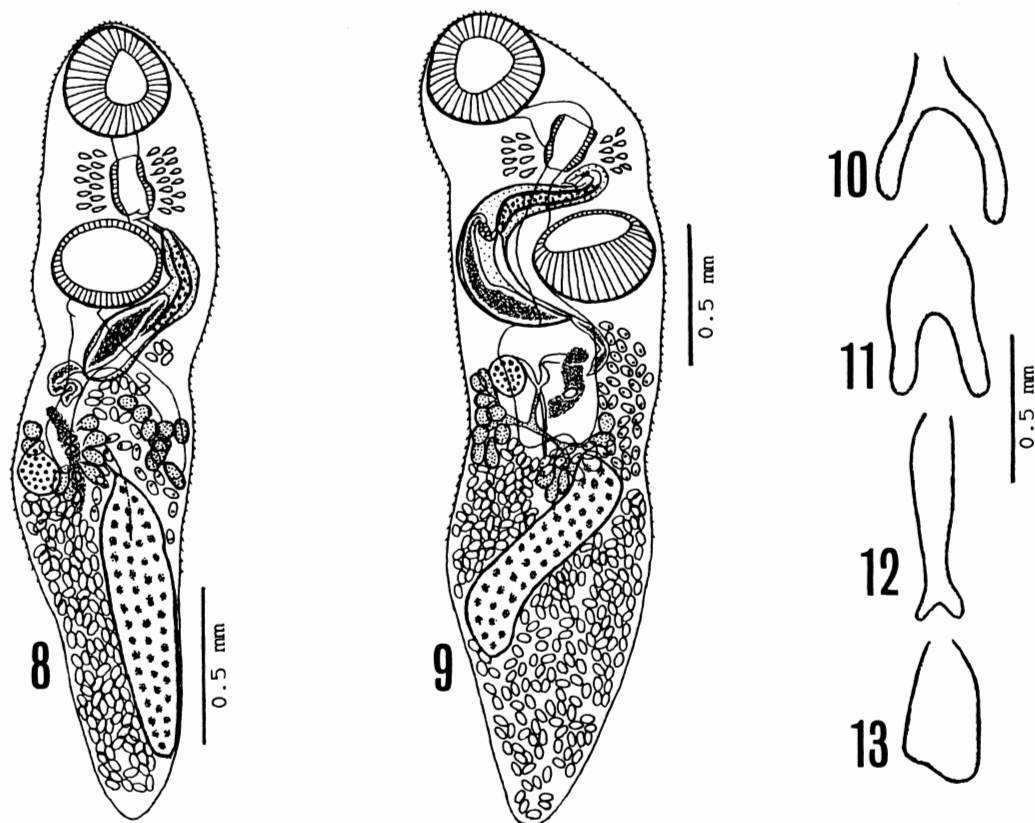
This species has various shapes of caecum, from double to single. 1) Caecum perfectly bifurcating without a stem (Fig. 10). 2) Caecum bifurcating at the middle, having a short stem and branches (Fig. 11). 3) Caecum not bifurcating, having two protuberances at the termination (Fig. 12). 4) Caecum completely single, saccular (Fig. 13). The other features make no difference.

1. Forms with double caeca corresponding to the above 1 and 2 (Fig. 8).

Material examined. One specimen from gastric cardia of *Mugil cephalus*(?), Ambon, Indonesia, 23-I-1993 (NSMT-P1 4318, paratype); 2 specimens from gastric cardia of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 13-V-1993, (4353, paratypes); 5 specimens from gastric cardia of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 14-V-1993 (4364, holotype and 4 paratypes); 1 specimen from gastric cardia of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 17-V-1993 (4377, paratype); and 1 specimen from gastric cardia of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 7-X-1994 (4748, paratype).

Description. Based on 10 specimens. Body nearly fusiform, rounded anteriorly and tapering posteriorly, 2.00–3.14 long by 0.58–0.79 wide at acetabular level. Tegument spinose from anterior end to midlevel of testis. Cervical glands present. Oral sucker rounded, subterminal, 0.27–0.40 × 0.33–0.43; prepharynx 0.10–0.34 long; pharynx barrel-shaped, 0.16–0.22 × 0.12–0.18; esophagus 0.16–0.45 long, usually bifurcating near posterior to acetabulum; caeca extending to anterior third of hindbody or more posteriorly. Acetabulum almost spherical, 0.27–0.35 × 0.31–0.42. Sucker ratio 1:0.9–1.1. Forebody 26–33% of body length.

Testis single, longitudinally elongated with smooth surface, 0.73–1.11 × 0.15–0.24, occupying middle of hindbody. Posttesticular space 17–33% of body length. Two vasa efferentia arising from anterior portion of testis and entering into external



Figs. 8–13 *Lecithobotrys stomachicola* sp. nov. 8. Wholemount with double caeca, ventral view (holotype, NSMT-P1 4364). 9. Wholemount with single caecum, ventral view (paratype, NSMT-P1 4291). 10–13. Various shapes of caecum, double to single.

seminal vesicle. External seminal vesicle tubular, 0.27–0.64 long, straight or winding, extending posteriorly to a level midway between acetabulum and ovary. Hermaphroditic sac slender or club-shaped, arcuate, 0.54–0.74 × 0.13–0.19, terminating posteriorly near posterior border of acetabulum or more posteriorly; contents including saccular internal seminal vesicle 0.17–0.41 long, small prostatic vesicle, female duct 0.07–0.28 long, and hermaphroditic duct 0.37–0.70 long, lined with cubic cells. Genital atrium short. Genital pore median, immediately anterior to acetabulum.

Ovary globular, 0.12–0.18 × 0.10–0.14, midway between acetabulum and testis or more posteriorly. Seminal receptacle absent and uterine seminal receptacle present. Laurer's canal running backward in a straight line and opening dorsally at midlevel of

testis. Vitelline follicles in two symmetrical groups, 9–10 follicles on each side of ovary. Uterus filling most of hindbody, extending to posterior end of body. Eggs elliptical, 52–63 × 30–39 μm. Miracidial eyespots present in eggs of distal portion of uterus. Excretory vesicle tubular, reaching near ovary; pore terminal or subventral.

2. Forms with single caecum (Fig. 9).

Material examined. Five specimens from gastric cardia of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 26-V-1992 (NSMT-P1 4291, paratypes); 3 specimens from gastric cardia of *Mugil cephalus*(?), Ambon, Indonesia, 1-II-1993 (4345, paratypes) and 2 specimens from gastric cardia of *Mugil cephalus*(?), Lombok, Indonesia, 21-I-1994 (4630, paratypes).

Description. Based on 10 specimens. Body 1.92–3.04 long by 0.48–0.80 wide. Oral sucker 0.24–0.37 × 0.28–0.42. Prepharynx 0.17–0.28 long. Pharynx 0.14–0.19 × 0.10–0.17. Esophagus 0.22–0.57 long, reaching near level of posterior border of acetabulum. Caeca single, saccular, extending to anterior third of hindbody or more posteriorly. Acetabulum 0.24–0.35 × 0.34–0.45. Sucker ratio 1:1.0–1.2. Forebody 24–35% of body length. Testis 0.44–0.91 × 0.11–0.19. Posttesticular space 21–36% of body length. Hermaphroditic sac 0.50–1.01 × 0.14–0.20. Ovary 0.09–0.17 × 0.08–0.13. Vitelline follicles in two symmetrical bunches, 8–10 usually 9 follicles on each side of ovary. Eggs 47–65 × 29–35 μm.

Remarks. In an instance of 52 specimens obtained from the same host individual, 22 have double caeca and 30 have single caecum.

Depending on whether the caecum is double or single, the present species falls within the genus *Lecithobotrys* of the subfamily Haploporinae or the genus *Pseudounicoelium* of the subfamily Unisaccinae. Four species of *Lecithobotrys* have been described, all from the intestine of mugilid fishes: *L. putresceus* Looss, 1902, *L. vitellosus* Sharma et Gupta, 1970, *L. sprengi* Martin, 1973 and *L. mugilis* Rekharani et Madhavi, 1985. Furthermore, opinion differs as to synonymy between *Saccocoelioides* and *Lecithobotrys*, and also among the species assigned to *Saccocoelioides* by Szidat (1954). Nasir and Gomez (1976) considered *Saccocoelioides* a synonym of *Lecithobotrys*, whereas Yamaguti (1971) regarded *Saccocoelioides* as a valid genus. Kohn (1985) gave new morphological data, measurements and figures based on syntypes of the species of *Saccocoelioides* described by Szidat in 1954. The present species with double caeca is most like *L. vitellosus* in the hermaphroditic sac extending posterior to the acetabulum and the testis lying posterior to the caecal termination, but differences are observed in that the latter has the intestinal bifurcation located anterior to the acetabulum, and smaller eggs. On the other hand, *Pseudounicoelium* contains two species, *P. overstreeti* Ahmad, 1987 and *P. guptai* Ahmad, 1987, both from the intestine of mugilid fish of India. The present species with single caecum resembles *P. overstreeti* in the genital pore opening at the anterior edge of acetabulum, but differs from it

in sucker ratio, site and size of testis and hermaphroditic sac, and size of eggs.

As mentioned above, each of the present species has the same features except for the caecum. The caecum appears to be an unstable character for the present species. Haploporine members should be divided into some groups based on the shape of vitellaria, and then classify the each group according to single or double caecum if necessary. The subfamily Unisaccinae may possibly be withdrawn. I place the present species in the genus *Lecithobotrys* of the subfamily Haploporinae.

Family Haplosporinae
Hymenocotta mulli Manter, 1961
(Figs. 14–16)

Material examined. Two specimens from intestine of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 26-I-1990 (NSMT-P1 3841a); 1 specimen from intestine of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 14-V-1993 (4366) and 1 specimen from intestine of *Crenimugil crenilabis*, Nago, Okinawa Prefecture, Japan, 17-V-1993 (4378).

Description. Based on 4 specimens. Body 4.5–6.1 long by 1.3–1.5 wide at acetabular level. Oral sucker 6-lobed, 0.76–0.95 × 1.04–1.22, at least 10 pairs of papillae on lobes; prepharynx 0.19–0.38 long; pharynx pot-shaped, 0.48–0.54 × 0.35–0.47; esophagus 0.10–0.28 long; caecum with two protuberances at the posterior end and extending a little anterior to testis. Acetabulum cup-shaped, 0.83–0.93 × 0.80–0.91. Forebody 29–34% of body length.

Testis longitudinally elongated, 0.65–1.07 × 0.40–0.82, usually at posterior end of body. Male genital duct terminating in small prostatic vesicle, which connects with female metraterm near the middle, a little posterior to genital pore. Cirrus sac absent. Genital pore median, anterior to acetabulum.

Ovary rounded to ovoid, 0.26–0.38 × 0.29–0.36, just anterior or anteroventral to testis. Oviduct slender, consisting of circular musclad, connecting with posterior corner of seminal receptacle, then arising from another posterior corner, receiving vitelline duct and entering ootype. Laurer's canal absent. Seminal receptacle large, ovoid, 0.51–0.90 × 0.33–0.55, anterior to ovary. Uterus preovarian. Eggs 90–

109 × 72–88 μm. Vitellaria consisting of irregular-shaped longitudinal tubules, in hindbody. Excretory vesicle V-shaped.

Remarks. This species has previously been recorded from Fiji, Australia, New Caledonia and India (Manter, 1961; Cribb *et al.*, 1994; etc.). The oral sucker was observed to be bowl-shaped with six shallow notches in a non-flattened specimen, whereas it had the appearance of a six-lobed disk as shown Fig. 14 which is like Manter's figure (1961, Fig. 2) in a flattened specimen. The male duct ended in a small prostatic vesicle which joined a female duct near the middle of the metraterm (Fig. 15). I agree with Cribb *et al.* (1994) that there is no cirrus sac in *H. mulli*.

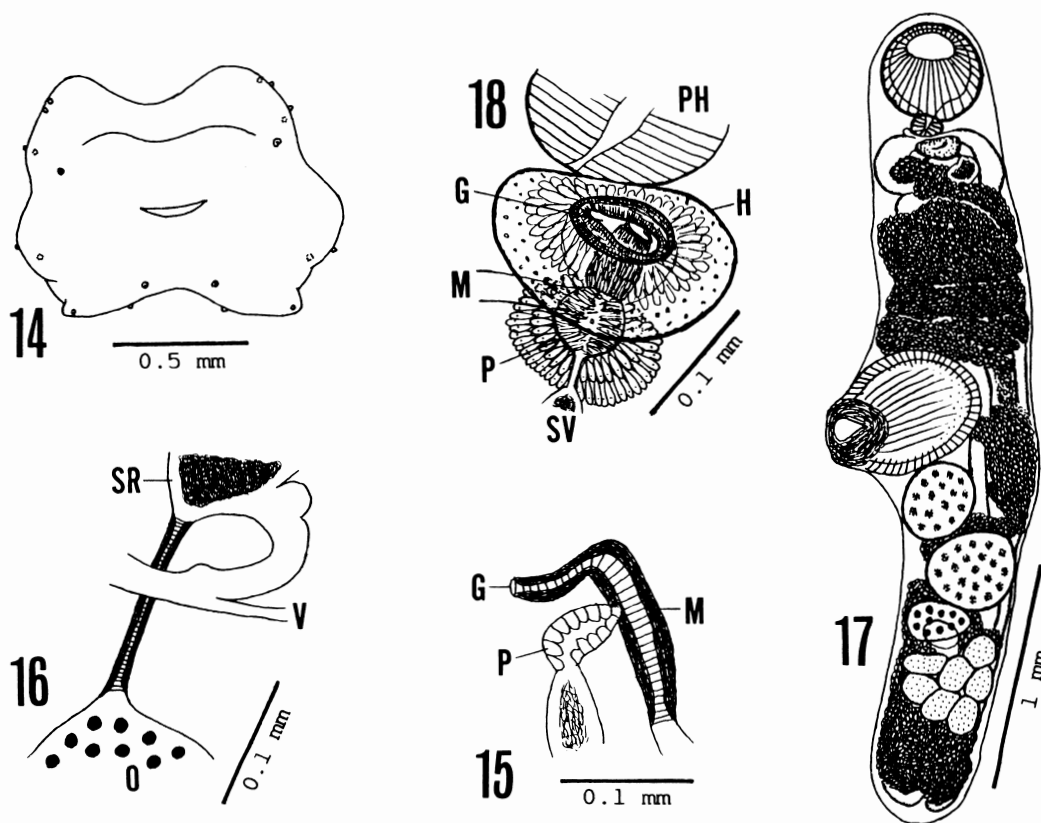
Family Hemiuridae

Hysterolecitha indonesiana sp. nov.

(Figs. 17 and 18)

Material examined. One specimen from stomach of *Mugil cephalus*(?), Ambon, Indonesia, 23-I-1993 (NSMT-P1 4319, paratype) and 2 specimens from stomach of *Mugil cephalus*(?), Ambon, Indonesia, 30-I-1993 (4337, holotype and 1 paratype).

Description. Based on 3 specimens. Body elongate, nearly cylindrical, 3.5–3.8 long by 0.89–1.00 wide at acetabular level, with blunt-pointed extremities. Forebody wider than hindbody, 0.65–0.70 wide at level midway between suckers and 0.44–0.53 wide at ovarian level. Oral sucker rounded, subterminal, 0.41–0.48 × 0.47–0.57; prepharynx



Figs. 14–16 *Hymenocotta mulli* Manter, 1961. 14. Oral sucker, showing papillae on lobes. 15. Terminal genitalia, ventral view. 16. Ovarian complex, ventral view.

Figs. 17 and 18 *Hysterolecitha indonesiana* sp. nov. 17. Wholemount, ventral view (holotype, NSMT-P1 4337). 18. Hermaphroditic sac, ventral view. G, genital pore; H, hermaphroditic sac; M, metraterm; O, ovary; P, prostatic vesicle; PH, pharynx; SR, seminal receptacle; SV, seminal vesicle; V, vitelline duct.

not recognized; pharynx globular, $0.09-0.17 \times 0.14-0.18$; esophagus very short, up to 0.05 long; caeca terminating near posterior end of body. Acetabulum stout, $0.50-0.63 \times 0.69-0.85$, with well-developed muscular sphincter around the orifice. Sucker ratio 1:1.5-1.6. Forebody 49-53% of body length.

Testes rounded to ovoid, tandem, overlapping in part or slightly separated; anterior testis $0.17-0.33 \times 0.33-0.34$, just posterior to or partly overlapping acetabulum; posterior testis $0.27-0.36 \times 0.35-0.41$. Seminal vesicle saccular, extending posteriorly to midway between suckers. Prostatic vesicle small, $0.04-0.07$ long, surrounded by prostatic cells. Male and female ducts uniting just within hermaphroditic sac. Hermaphroditic sac small, $0.10-0.18 \times 0.18-0.22$. Hermaphroditic duct short and straight. Genital atrium shallow, encircled with glandular cells. Genital pore median, immediately posterior to pharynx.

Ovary rounded to ovoid, $0.16-0.21 \times 0.21-0.30$, near middle of hindbody, touching posterior testis. Vitellaria 7-8 lobed; lobes rounded or ovoid, close together. Juel's organ ovoid, $0.12-0.20 \times 0.11-0.19$, in ovarian zone. Uterine seminal receptacle may be present. Uterus extensive, filling hindbody as well as forebody, extending from posterior end of body to a level just postbifurcal. Eggs $32-39 \times 18-22 \mu\text{m}$. Excretory arms uniting dorsal to oral sucker; pore terminal.

Remarks. The presence of a Juel's organ and the absence of a seminal receptacle indicate that this species belongs to the genus *Hysterolecitha* (Gibson and Bray, 1979). This species differs from all others in *Hysterolecitha* in having an acetabulum which possesses a muscular sphincter around the orifice, and a uterus lying in the forebody as well as the hindbody.

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References

- Ahmad, J. (1987): On seven new digenetic trematodes of marine fishes from the Arabian Sea, off the Panjim coast, Goa. *Pakistan J. Zool.*, 19, 321-340.
- Bargiela, J. F. (1987): Los parásitos de la lisa *Mugil cephalus* L., en Chile: sistemática y aspectos poblacionales (Perciformes: Mugilidae). *Gayana, Zool.*, 51, 3-58.
- Cribb, T. H., Bray, R. A. and Barker, S. C. (1994): Bivesiculidae and Haplosporinidae (Digenea) from fishes of the southern Great Barrier Reef, Australia. *Syst. Parasitol.*, 28, 81-97.
- Fares, A. and Maillard, C. (1974): Recherches sur quelques Haploporidae (Trematoda) parasites des muges de Méditerranée Occidentale: systématique et cycles évolutifs. *Z. Parasitenk.*, 45, 11-43.
- Gibson, D. I. and Bray, R. A. (1979): The Hemiuroidea: terminology, systematics and evolution. *Bull. Br. Mus. Nat. Hist. (Zool.)*, 36, 35-146.
- Kohn, A. (1985): On the species described by Szidat in 1954 in the genus *Saccocoelioides* (Digenea: Haploporidae). *Mem. Inst. Oswaldo Cruz*, 80, 387-393.
- Looss, A. (1902): Die Distomen-Unterfamilie der Haploporinae. *Arch. Parasitol.*, 6, 129-143.
- Machida, M. (1980): Hemiurid trematodes of *Kyphosus* collected around Cape Shionomisaki, Kii Peninsula. *Mem. Natn. Sci. Mus., Tokyo*, (13), 113-120.
- Machida, M. (1993): Trematodes from kyphosid fishes in Japanese and adjacent waters. *Bull. Natn. Sci. Mus., Tokyo, Ser. A*, 19, 27-36.
- Machida, M. and Uchida, A. (1990): Trematodes from unicornfishes of Japanese and adjacent waters. *Mem. Natn. Sci. Mus., Tokyo*, (23), 69-81.
- Manter, H. W. (1961): Studies on digenetic trematodes of fishes of Fiji. I. Families Haplosporinidae, Bivesiculidae, and Hemiuridae. *Proc. Helminth. Soc. Wash.*, 28, 67-74.
- Martin, W. E. (1973): A new subfamily, two new genera, and three new species of haploporid trematodes. *Ibid.*, 40, 112-117.
- Nasir, P. and Gomez, Y. (1976): *Carassotrema tilapiae* n. sp. (Haploporidae Nicoll, 1914) from the freshwater fish, *Tilapia mossambica* (Peters), in Venezuela. *Riv. Parassitol.*, 37, 207-228.
- Overstreet, R. M. (1971): Some adult digenetic trematodes in striped mullet from the northern Gulf of Mexico. *J. Parasitol.*, 57, 967-974.
- Overstreet, R. M. (1982): *Forticulcita glabra* gen. et sp. nov. (Digenea: Haploporidae) in a Red Sea mullet. *Zool. Scripta*, 11, 83-85.
- Rekharani, Z. and Madhavi, R. (1985): Digenetic trematodes from mullets of Visakhapatnam (India). *J. Nat. Hist.*, 19, 929-951.
- Sharma, P. N. and Gupta, A. N. (1970): *Lecithobotrys vitellosus* n. sp. (Haploporidae: Trematoda) from India. *Riv. Parassitol.*, 31, 175-178.

- 18) Srivastava, H. D. (1939): The morphology and systematic relationships of a new parasite, *Waretremapiscicola* gen. et sp. n. referable to a new family Waretrematidae of digenetic trematodes. Ind. J. Vet. Sci. Anim. Husband., 9, 169–172.
- 19) Szidat, L. (1954): Trematodes nuevos de peces de agua dulce de la República Argentina y un intento para aclarar su carácter marino. Rev. Inst. Nac. Invest. Mus. Argent. Cien. Nat., Zool., 3, 1–85.
- 20) Thatcher, V. E. and Sparks, A. K. (1958): A new species of *Dicrogaster* (Trematoda, Haploporidae) from *Mugil cephalus* in the Gulf of Mexico. J. Parasitol., 44, 647–648.
- 21) Velasquez, C. C. (1961): Some digenetic trematodes from Philippine fishes. *Ibid.*, 47, 521–525.
- 22) Wang, S. (1991): Haploporidae. In Fauna of Zhejiang, Trematoda, Wu, B., ed., Zhejiang Sci. and Tech., 295–301 (in Chinese).
- 23) Yamaguti, S. (1971): Synopsis of Digenetic Trematodes of Vertebrates. Keigaku Publ., Tokyo, 1074pp., 249pls.