

## Zoogonidae (Trematoda, Digenea) from Fishes of Japanese Waters

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**Abstract** Seven species of zoogonid digeneans (Trematoda) are described from fishes of Japanese waters. Three species of the subfamily Zoogoninae were collected from coastal fishes of southern Japan: *Diptherostomum brusinae* (Stossich, 1888) from *Goniistius zonatus* (Cheilodactylidae), *Diptherostomum plectorhynchi* sp. nov. from *Plectorhynchus cinctus* (Haemulidae), and *Zoogonoides pyriformis* Pritchard, 1963 from *Coris aygula* (Labridae). Four species of the subfamily Lepidophyllinae were obtained from deep-sea fishes of Suruga Bay and the Sagami Sea, off the Pacific coast of central Japan: *Lepidophyllum lepidotriglae* sp. nov. from *Lepidotrigla guentheri* (Triglidae), *Neosteganoderma glandulosum* Byrd, 1964 from *Physiculus maximowiczi* (Moridae), *Neosteganoderma physiculi* sp. nov. from *Physiculus japonicus* and *P. maximowiczi* (Moridae), and *Proctophantastes nettastomatis* sp. nov. from *Nettastoma parviceps* (Nettastomatidae).

**Key words:** Digenea, Zoogonidae, new species, coastal fish, deep-sea fish, Japan.

This paper deals with seven species of the family Zoogonidae (Trematoda, Digenea) from fishes of Japanese waters. Of them, three species of the subfamily Zoogoninae were collected from coastal fishes of southern Japan, and four species of the subfamily Lepidophyllinae were from deep-sea fishes of Suruga Bay and the Sagami Sea, off the Pacific coast of central Japan. Digeneans were washed in saline, fixed in AFA under slight pressure, stained with Heidenhain's hematoxylin and mounted in Canada balsam. Sectioned material was stained with Delafield's hematoxylin with eosin as a counterstain. The specimens are deposited in the National Science Museum, Tokyo (NSMT-PI), the Showa Memorial Institute, National Science Museum, Tokyo (NSMT-PI S), and the Meguro Parasitological Museum (MPM). Measurements are given in millimeters unless otherwise indicated.

Family Zoogonidae Odhner, 1902

Subfamily Zoogoninae Odhner, 1902

*Diptherostomum brusinae* (Stossich, 1888)

(Fig. 1)

**Material.** Fifty specimens from rectum of *Goniistius zonatus* (Cuvier) (Cheilodactylidae), Fukaura, Ehime Prefecture, Japan, 23-V-1972 (NSMT-PI 978), coll. M. Machida.

**Description.** Based on 10 whole-mounts. Body 0.69–0.95 long by 0.37–0.49 wide. Tegument spinose. Oral sucker 0.08–0.10×0.09–0.13, sometimes showing funnel-shaped; prepharynx unrecognizable; pharynx 38–59×43–64 μm; esophagus convoluted, 0.32–0.49 long, bifurcating nearer acetabulum than pharynx; caeca saccular, terminating pre- to midacetabular level. Acetabulum 0.15–0.22×0.19–0.26. Sucker ratio 1 : 1.7–2.7. Forebody 49–57% of body length.

Testes longer than wide, on each lateral side of acetabulum, immediately posterior to caecal termination; right testis 0.17–0.31×0.07–0.14 and

† Deceased February 5, 2001

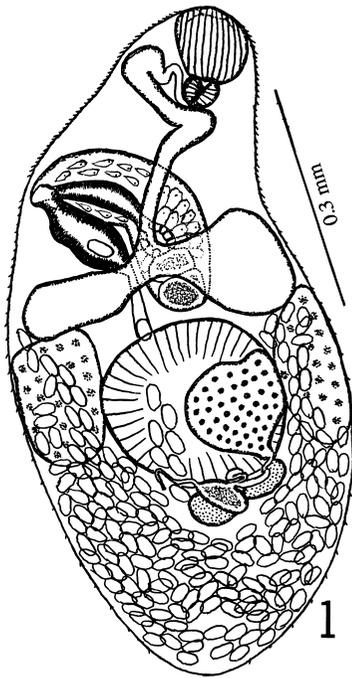


Fig. 1. *Diptherostomum brusinae* (Stossich, 1888). Entire worm, dorsal view (original, NSMT-PI 978).

left testis  $0.17\text{--}0.23 \times 0.07\text{--}0.12$ . Cirrus sac arcuate,  $0.22\text{--}0.34 \times 0.10\text{--}0.12$ , ending near anterior border of acetabulum or more posteriorly; containing bipartite seminal vesicle  $51\text{--}138 \mu\text{m}$  long as a whole, pars prostatica  $33\text{--}89 \mu\text{m}$  long, prostatic cells, and eversible cirrus  $0.14\text{--}0.20$  long. Cirrus with fine spines. Genital pore sinistral, marginal, at a level midway between pharynx and acetabulum.

Ovary  $0.11\text{--}0.18 \times 0.09\text{--}0.18$ , dorsal to acetabulum, at or slightly posterior to level of testes, usually close to right testis. Oviduct arising from posterior end of ovary, receiving short duct from anterodextral margin of seminal receptacle, then common vitelline duct, and entering Mehlis' gland. Laurer's canal originating from left corner of seminal receptacle, and opening near midposterior border of acetabulum. Seminal receptacle elongated oval,  $51\text{--}97 \times 35\text{--}64 \mu\text{m}$ , median, in contact with posterior margin of acetabulum. Uterus filling most of hindbody and lateral to acetabulum. Metraterm muscular,  $0.14\text{--}0.23 \times$

$0.04\text{--}0.07$ . Eggs thin-shelled,  $37\text{--}43 \times 18\text{--}22 \mu\text{m}$ . Vitellaria composed of two compact masses, on both sides of seminal receptacle, each connecting by a short isthmus; right vitellarium  $48\text{--}120 \times 43\text{--}77 \mu\text{m}$  and left vitellarium  $38\text{--}82 \times 35\text{--}77 \mu\text{m}$ . Excretory vesicle saccate,  $53\text{--}90 \times 51\text{--}102 \mu\text{m}$ ; pore terminal or subterminal.

*Remarks.* The present specimens agree well with the diagnosis of *Diptherostomum brusinae* by Bray & Gibson (1986) except they have slightly wider bodies, longer esophagi, and larger testes and ovaries.

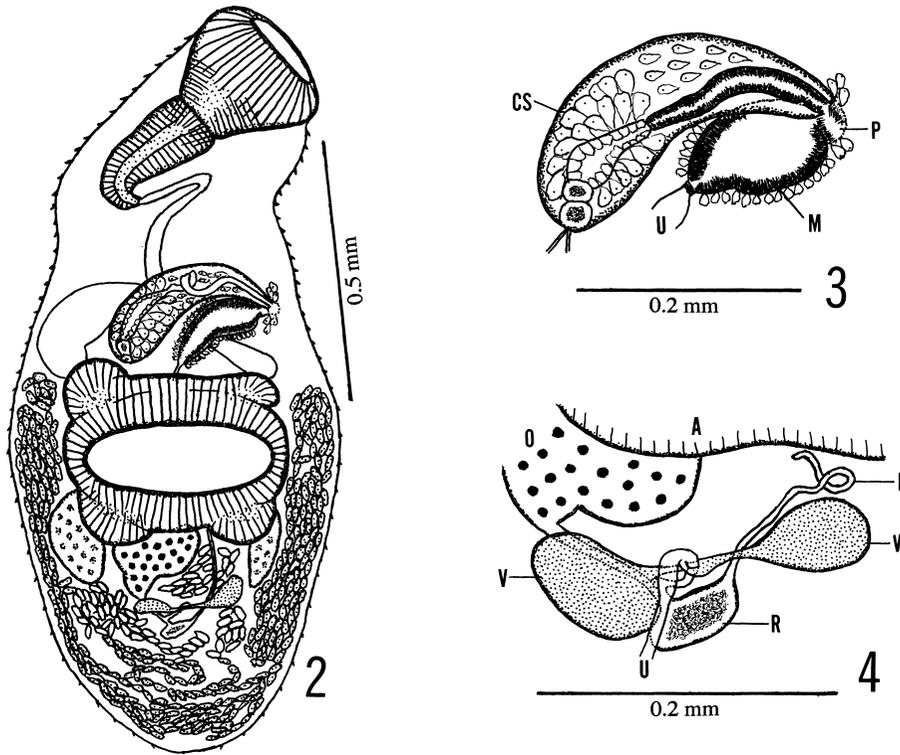
In Japan, Yamaguti (1934) recorded this species from *Lethrinus haematopterus* (Lethrinidae) from the Inland Sea. Yamaguti (1938) later described *D. spari* as a new species from *Sparus longispinis* (Sparidae) from Lake Hamana, but Bray (1986) reduced it to synonymy with *D. brusinae*. We also obtained this species from *Diagramma pictum* (Haemulidae) from Fukaura, Ehime Prefecture (NSMT-PI 1019a). The specimen which Machida *et al.* (1970) reported as *Zoogonoides* sp. from *Chrysophrys major* (= *Pagrus major*) (Sparidae) from Tsushima Island (NSMT-PI 1664c) should be corrected to *D. brusinae*.

#### *Diptherostomum plectorhynchi* sp. nov.

(Figs. 2–4)

*Material.* Two specimens from intestine of *Plectorhynchus cinctus* (Temminck & Schlegel) (Haemulidae), Ogasawara Islands, Japan, 6-VII-1976 (NSMT-PI 1984, holotype & 1 paratype), coll. M. Machida.

*Description.* Based on 2 whole-mounts. Body small, elongate fusiform,  $1.38\text{--}1.43$  long by  $0.47\text{--}0.60$  wide. Tegument spinose, sparse posteriorly. Oral sucker subterminal, somewhat funnel-shaped,  $0.23 \times 0.23\text{--}0.26$ ; prepharynx unrecognizable; pharynx elongated conical, almost the same length as oral sucker,  $0.25\text{--}0.27 \times 0.12$ ; esophagus slender, sigmoid,  $0.36\text{--}0.46$  long, bifurcating midway between pharynx and acetabulum; caeca usually saccular, terminating a little



Figs. 2-4. *Diptherostomum plectorhynchi* sp. nov.—2. Entire worm, ventral view (holotype, NSMT-PI 1984). 3. Terminal genitalia, ventral view. 4. Ovarian complex, ventral view. Abbreviations: A, acetabulum; CS, cirrus sac; L, Laurer's canal; M, metraterm; O, ovary; P, genital pore; R, seminal receptacle; U, uterus; V, vitellarium.

overlapping acetabulum. Acetabulum wider than long,  $0.28-0.30 \times 0.40-0.42$ , having four wing-like projections. Sucker ratio 1:1.6-1.7. Forebody 59-62% of body length (Fig. 2).

Testes longitudinally elongated, on each lateral side of posterior region of acetabulum, partly overlapping it; right testis  $0.17-0.19 \times 0.09-0.10$  and left testis  $0.18-0.19 \times 0.09-0.10$ . Cirrus sac claviform, arcuate,  $0.32-0.38 \times 0.09-0.10$ , extending near anterior margin of acetabulum; containing small bipartite seminal vesicle, pars prostatica  $0.09-0.11$  long with prostatic cells, and slender, slightly convoluted cirrus  $0.19-0.26$  long, lined with fur-like spines. Genital atrium shallow, surrounded by a small number of glandular cells (Fig. 3). Genital pore dorsal, near left body margin, at bifurcal level.

Ovary nearly ovoid,  $0.11-0.12 \times 0.17-0.19$ , posterodextral to acetabulum, partly overlapping

it. Oviduct arising from posterior end of ovary, receiving short duct from right side of seminal receptacle, then common vitelline duct, and entering Mehlis' gland. Laurer's canal originating from left end of seminal receptacle, convoluted, and opening slightly sinistral, near posterior border of acetabulum. Seminal receptacle transversely elongated,  $76-84 \times 30-38 \mu\text{m}$ , median, posterosinistral to ovary, immediately posterior to vitelline isthmus (Fig. 4). Uterus filling most of hindbody and lateral to acetabulum. Metraterm muscular,  $0.13-0.20 \times 0.07-0.09$ , surrounded by glandular cells. Eggs thin-shelled,  $30-36 \times 11-16 \mu\text{m}$ . Vitellaria consisting of two subglobular masses which lie roughly on both sides of seminal receptacle; right vitellarium  $38-56 \times 86-102 \mu\text{m}$  and left vitellarium  $51-90 \times 51-84 \mu\text{m}$ . Two vitellaria connecting with each other by a slender isthmus from which common vitelline duct leads.

Excretory vesicle saccate,  $80\text{--}90 \times 60\text{--}105 \mu\text{m}$ ; pore subterminal.

*Remarks.* The present new species differs from all others in the genus *Diptherostomum* by having an elongated conical pharynx, almost the same length of the oral sucker. This species was also obtained from *Diagramma pictum* (Haemulidae) from Fukaura, Ehime Prefecture (NSMT-PI 1019b), and from *Plectorhynchus lineatus* (Haemulidae) from Ishigaki Island, Okinawa Prefecture (NSMT-PI 1260). Both specimens are immature or in poor condition.

*Zoogonoides pyriformis* Pritchard, 1963

(Fig. 5)

*Material.* Four specimens from intestine of *Coris aygula* (Lacepède) (Labridae), Nago, Okinawa Prefecture, Japan, 11-III-1996 (NSMT-PI 4897), coll. M. Machida.

*Description.* Based on 4 whole-mounts. Body short spindle-shaped with bluntly pointed ends, 1.02–1.18 long by 0.49–0.55 wide. Tegument spinose, sparse posteriorly. Oral sucker spherical or ovoid,  $0.11\text{--}0.15 \times 0.16\text{--}0.18$ ; prepharynx  $12\text{--}64 \mu\text{m}$  long; pharynx subglobular,  $45\text{--}50 \times 70\text{--}80 \mu\text{m}$ ; esophagus short,  $0.10\text{--}0.12$  long, bifurcating midway between pharynx and acetabulum; caeca extending mid- to postacetabular level. Acetabulum spherical,  $0.25\text{--}0.30 \times 0.27\text{--}0.30$ , with lip-like projections on anterior and posterior margins. Sucker ratio 1:1.6–1.8. Fore-body 45–53% of body length.

Testes ovoid, slightly longer than wide, anterolateral or lateral to acetabulum, sometimes overlapping caeca; right testis  $0.15\text{--}0.17 \times 0.10\text{--}0.13$  and left testis  $0.13\text{--}0.19 \times 0.09\text{--}0.12$ . Cirrus sac club-shaped, slightly arcuate,  $0.21\text{--}0.27 \times 0.10\text{--}0.12$ , extending just anterior to or within acetabular zone; containing bipartite seminal vesicle  $89\text{--}128 \mu\text{m}$  long as a whole, pars prostatica vesicular,  $51\text{--}87 \mu\text{m}$  long, prostatic cells, and cirrus  $61\text{--}97 \mu\text{m}$  long. Cirrus lined with short hair-like spines. Genital pore near sinistral margin of body, at bifurcal level.

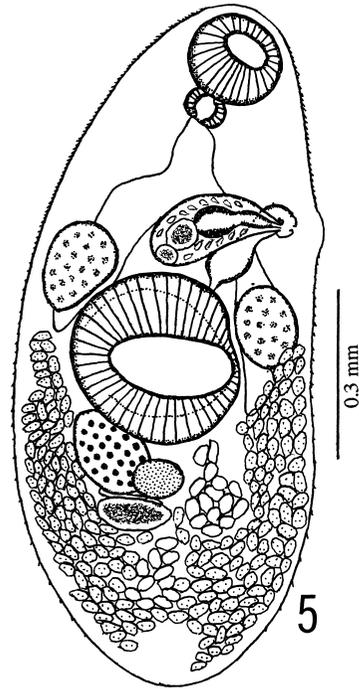


Fig. 5. *Zoogonoides pyriformis* Pritchard, 1963. Entire worm, ventral view (original, NSMT-PI 4897).

Ovary ovoid,  $0.11\text{--}0.14 \times 0.14\text{--}0.18$ , variable in position from just posterodextral to posterosinistral to acetabulum. Seminal receptacle  $61\text{--}85 \times 114\text{--}123 \mu\text{m}$ , immediately posterior to ovary. Laurer's canal usually opening middorsally just posterior to vitellaria. Uterus filling most of body posterior to testes. Eggs thin-shelled,  $46\text{--}65 \times 25\text{--}33 \mu\text{m}$ . Metraterm  $0.17\text{--}0.21$  long. Vitellaria in a compact mass,  $56\text{--}72 \times 99\text{--}120 \mu\text{m}$ , lateral or laterodorsal to sometimes partly overlapping ovary. Excretory vesicle saccate,  $80\text{--}115 \times 83\text{--}110 \mu\text{m}$ ; pore at or near posterior end.

*Remarks.* Pritchard (1963) initially described *Zoogonoides pyriformis* from *Malacanthus hoedtii* (Malacanthidae) from Hawaii. Yamaguti (1970) reported *Z. synodi* as a new species from *Synodus dermatogenys* (Synodontidae) from Hawaii, but Bray (1986) reduced it to synonymy with *Z. pyriformis*. Madhavi (1979) illustrated the figure (without description) of *Z. pyriformis*

from *Cheilinus diagramma* (Labridae) from India. The present material is alike *Z. pyriformis* in possessing a short esophagus, an acetabulum larger than the oral sucker, caeca ending in the acetabular zone, a preacetabular cirrus sac, etc. However, the present material has a considerably larger body with correspondingly larger organs except egg size. Variation exists in egg size of this species. The eggs in our material overlap the measurement (46 to 54 by 23 to 28  $\mu\text{m}$ ) given by Yamaguti (1970). We provisionally place our material in *D. pyriformis*.

Subfamily Lepidophyllinae Stossich, 1903

*Lepidophyllum lepidotriglae* sp. nov.

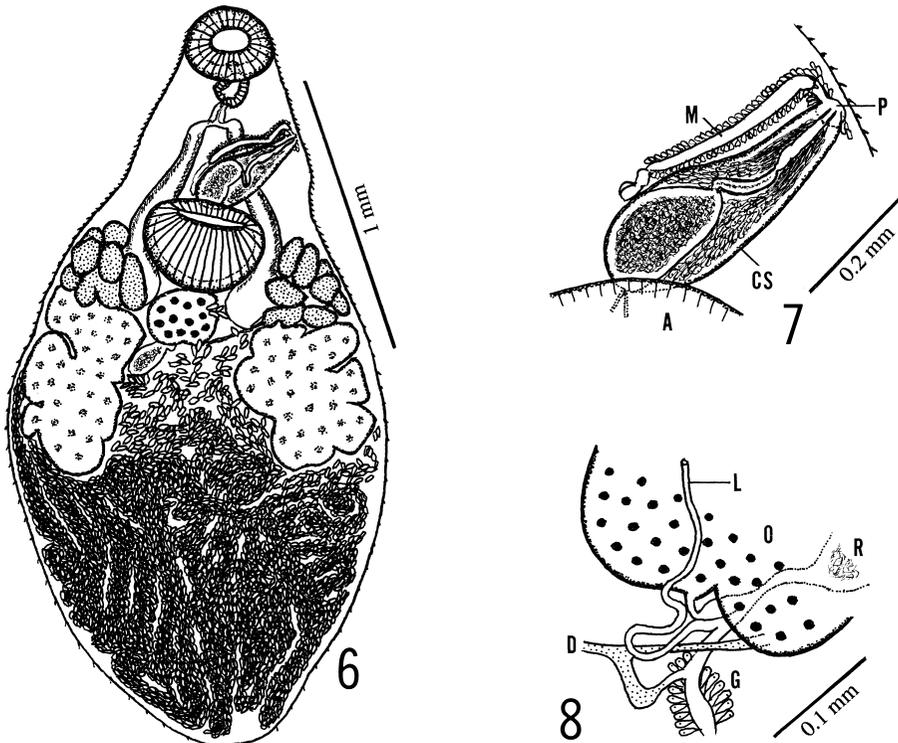
(Figs. 6–8)

*Material.* Four specimens from urinary bladder

of *Lepidotrigla guentheri* Hilgendorf (Triglidae), Suruga Bay, Japan, 27-III-1974 (MPM Coll. 20108, holotype & 2 paratypes), coll. Sh. Kamegai.

*Description.* Based on 3 whole-mounts. Body pyriform, 2.55–2.63 long by 1.30–1.50 wide. Tegument spinose. Oral sucker subterminal, rounded, 0.24–0.27 $\times$ 0.27–0.31; prepharynx very short, 0.03–0.06 long; pharynx 0.12–0.15 $\times$ 0.12–0.14; esophagus short, muscular, 0.07–0.11 long, bifurcating much nearer pharynx than acetabulum; caeca lined with tall villous epithelia, passing lateral sides of acetabulum and terminating at ovarian level. Acetabulum usually cup-shaped, 0.31–0.33 $\times$ 0.39–0.43. Sucker ratio 1: 1.3–1.4. Forebody 31–33% of body length (Fig. 6).

Testes usually with deep incisions, on each side of equator, in contact with or overlapping



Figs. 6–8. *Lepidophyllum lepidotriglae* sp. nov.—6. Entire worm, ventral view (holotype, MPM Coll. 20108). 7. Terminal genitalia, ventral view. 8. Ovarian complex, dorsal view. Abbreviations: A, acetabulum; CS, cirrus sac; D, vitelline duct; G, Mehlis' gland; L, Laurer's canal; M, metraterm; O, ovary; P, genital pore; R, seminal receptacle.

posterior lobes of vitellaria; right testis  $0.51-0.61 \times 0.35-0.54$  and left testis  $0.44-0.61 \times 0.38-0.48$ . Posttesticular space 34–36 % of body length. Cirrus sac claviform, almost straight,  $0.40-0.43 \times 0.16-0.18$ , slightly overlapping anterior border of acetabulum in posterior extent; containing bipartite seminal vesicle, pars prostatica  $75-110 \mu\text{m}$  long with prostatic cells, and cirrus  $30-65 \mu\text{m}$  long. Proximal portion of seminal vesicle saccular,  $0.20-0.22 \times 0.11-0.13$  and distal portion tubular, muscular,  $116-140 \mu\text{m}$  long (Fig. 7). Genital pore sinistral, dorso-submarginal, at bifurcal or slightly postbifurcal level.

Ovary ovoid, with uneven surface,  $0.20-0.24 \times 0.22-0.29$ , median, just posterior to or touching posterior border of acetabulum. Oviduct arising from posterior portion of ovary, receiving short duct from seminal receptacle, giving off Laurer's canal, connecting with common vitelline duct, then entering Mehlis' gland. Seminal receptacle elongated,  $0.20-0.30 \times 0.09-0.13$ , posterodextral to ovary. Laurer's canal convoluted, opening near anterior margin of ovary. Mehlis' gland posterior to ovary (Fig. 8). Uterus filling body posterior to ovary and testes. Metraterm slender, muscular,  $0.29-0.30$  long, covered with glandular cells, parallel to cirrus sac. Eggs  $51-64 \times 23-28 \mu\text{m}$ . Vitellaria in two lateral fields of posterior portions of caeca, overlapping anterior edge of testes; right vitellaria 9–10 follicles and left vitellaria 11–12 follicles. Excretory pore terminal; vesicle obscured by numerous eggs.

**Remarks.** The present new species is most similar to *Lepidophyllum armatum* Zhukov, 1957 in having an acetabulum slightly larger than the oral sucker, and a uterus that is not distributed radially, but differs from it in that *L. armatum* possesses a long cirrus sac extending to the postacetabular level, and smaller eggs 35 to 43 by 20 to  $25 \mu\text{m}$ .

***Neosteganoderma glandulosum* Byrd, 1964**

(Fig. 9)

**Material.** Two specimens from intestine of

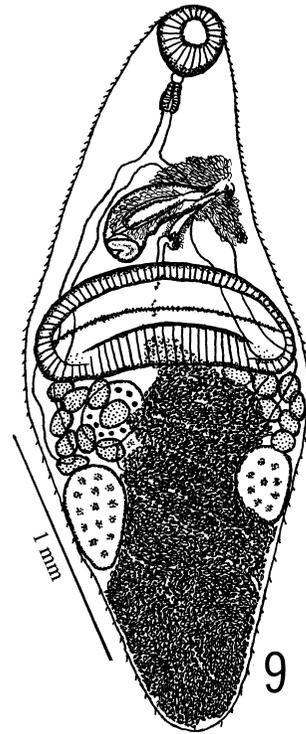


Fig. 9. *Neosteganoderma glandulosum* Byrd, 1964. Entire worm, ventral view (original, MPM Coll. 18496).

*Physiculus maximowiczi* (Herzenstein) (Moridae), Suruga Bay, Japan, 30-X-1973 (MPM Coll. 18463), and two specimens from intestine of *P. maximowiczi*, Suruga Bay, 20-III-1974 (MPM Coll. 18496), coll. Sh. Kamegai.

**Description.** Based on 4 whole-mounts. Body 2.17–2.85 long by 0.78–1.10 wide. Tegument spinose. Oral sucker  $0.22-0.28 \times 0.23-0.29$ ; prepharynx 0.04–0.06 long; pharynx  $0.10-0.14 \times 0.10-0.11$ ; esophagus 0.10–0.18 long, bifurcating midway between suckers or closer to oral sucker; caeca extending beyond acetabulum, near anterior border of testes. Acetabulum wider than long, almost as wide as body,  $0.32-0.46 \times 0.67-1.02$ , with equatorial division. Sucker ratio 1:2.8–3.9. Forebody 41–52% of body length.

Testes longer than wide, symmetrical, some distance posterior to acetabulum, sometimes overlapping posterior lobes of vitellaria; right testis  $0.33-0.43 \times 0.17-0.24$  and left testis

0.31–0.35×0.16–0.25. Posttesticular space 21–27% of body length. Cirrus sac claviform, straight or a little arcuate, 0.40–0.56×0.14–0.17, extending near or touching acetabulum; containing S-shaped seminal vesicle, slender pars prostatica 0.21–0.28 long with prostatic cells, and short cirrus 64–102 μm long. Seminal vesicle connecting with pars prostatica by short muscular duct 50–90 μm long. Genital atrium covered with thick coat of glandular cells; sac-like recesses are seen in one specimen. Genital pore sinistral, marginal or submarginal, near bifurcal level.

Ovary 0.18–0.27×0.20–0.32, dextral, touching or overlapping posterior border of acetabulum and a few lobes of right vitellaria. Oviduct arising from left margin of ovary, receiving short duct from seminal receptacle, then common vitelline duct, and entering Mehlis' gland. Seminal receptacle 0.16–0.26×0.14–0.23, posterosinistral to or touching ovary. Mehlis' gland almost median, immediately posterior to acetabulum. Laurer's canal opening at level of posterior border of seminal receptacle. Uterus filling available space of hindbody, and crossing longitudinally in middle of acetabulum before entering metraterm. Metraterm 0.26–0.40 long, surrounded by glandular cells. Eggs 30–34×17–19 μm. Vitellaria consisting of two lateral fields of 9 (right) and 7 (left) follicles which lie just posterior to acetabulum, sometimes partly overlapping acetabulum, testes and ovary. Excretory vesicle I-shaped, anterior extent not determined; pore terminal.

*Remarks.* Four specimens were collected from two out of 113 host individuals examined. Our specimens are indistinguishable from the description of *Neosteganoderma glandulosum* by Bray & Gibson (1986). According to Bray & Gibson (1986) and Bray (1987), this species has been recorded from *Polymixia lowei* (Polymixiidae) of NW Atlantic (Byrd, 1964), *Beryx decadactylus* (Berycidae) of NE Atlantic (Bray, 1973), *Polymixia japonica* of Mid-Pacific (Yamaguti, 1970) and *Cyttoidops mccullochi* and *Cyttus novaezealandiae* (Zeidae) of SW Pacific (Korotava, 1982). Though Yamaguti (1970) originally

named his specimen from Hawaii *Proctophantastes polymixiae*, Bray (1973) transferred it to the genus *Neosteganoderma*, and Bray & Gibson (1986) reduced it to synonymy with *N. glandulosum*. This species has not hitherto been reported from a morid fish and Japanese waters.

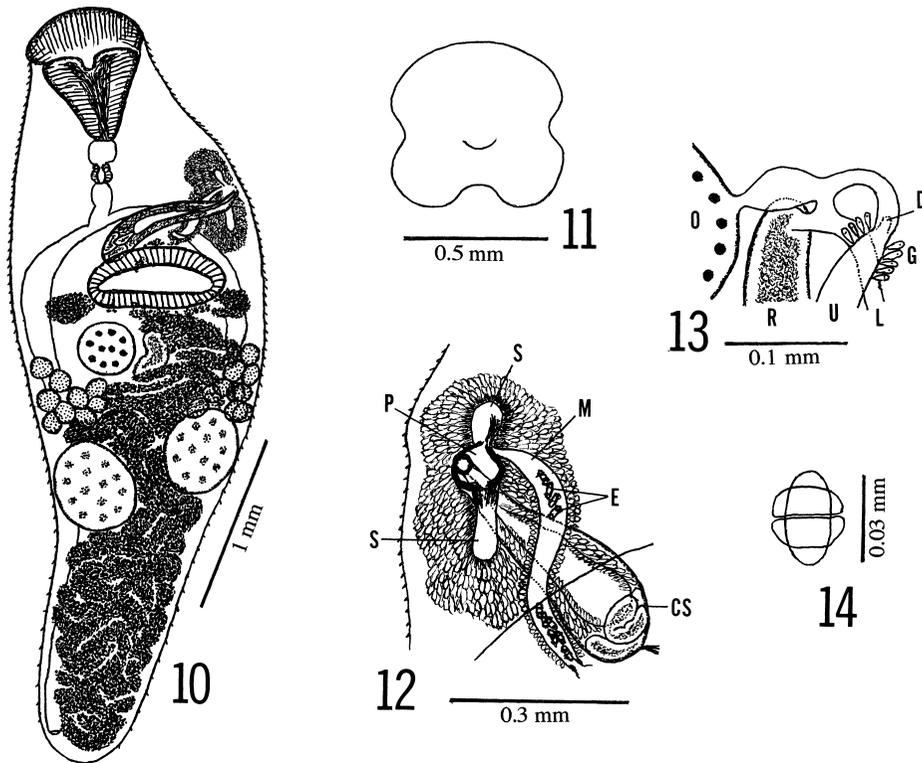
*Neosteganoderma physiculi* sp. nov.

(Figs. 10–14)

*Material.* Six specimens from intestine of *Physiculus maximowiczi* (Herzenstein) (Moridae), Suruga Bay, Japan, 20-III-1974 (MPM Coll. 19495, 4 paratypes), coll. Sh. Kamegai, and 25 specimens from pyloric caeca and intestine of *Physiculus japonicus* Hilgendorf, Sagami Sea, Japan, 26-III-2003 (NSMT-PI S48–50, holotype & 7 paratypes, *Neosteganoderma* sp. of Kuramochi (2006)), coll. T. Kuramochi.

*Description.* Based on 12 whole-mounts and 2 sets of serial sections. Body fusiform, 2.57–4.63 long by 1.00–1.70 wide. Tegument spinose (Fig. 10). Oral sucker large, funnel-shaped, 0.56–0.76×0.48–0.75, anterior margin with three depressions, one ventral and two lateral (Fig. 11); prepharynx 0.03–0.22 long; pharynx globular, 0.12–0.16×0.14–0.17; esophagus short, 0.10–0.25 long, bifurcating midway between pharynx and acetabulum or occasionally in contact with anterior margin of acetabulum; caeca long, opening through separate ani near posterior end of body. Acetabulum wider than long, 0.26–0.40×0.66–1.04. Sucker ratio 1:1.0–1.5. Forebody 36–44% of body length.

Testes spherical to ovoid, usually slight diagonal, right testis 0.33–0.60×0.32–0.46 and left testis 0.35–0.53×0.19–0.45. Posttesticular space 25–33% of body length. Cirrus sac claviform, arcuate, 0.43–0.93×0.12–0.19, terminating posteriorly at pre- to midacetabular level; containing folded seminal vesicle, pars prostatica 0.22–0.51 long with prostatic cells, and cirrus 0.08–0.21 long. Genital atrium shallow, with two atrial sacs 0.12–0.23 long, surrounded by thick layer of glandular cells (Fig. 12). Genital pore sinistral,



Figs. 10–14. *Neosteganoderma physiculi* sp. nov.—10. Entire worm, ventral view (holotype, NSMT-PI S49). 11. Oral sucker, apical view. 12. Terminal genitalia, dorsal view. 13. Ovarian complex, ventral view. 14. Egg. Abbreviations: CS, cirrus sac; D, vitelline duct; E, egg; G; Mehlis' gland; L, Laurer's canal; M, metraterm; O, ovary; P, genital pore; R, seminal receptacle; S, atrial sac; U, uterus.

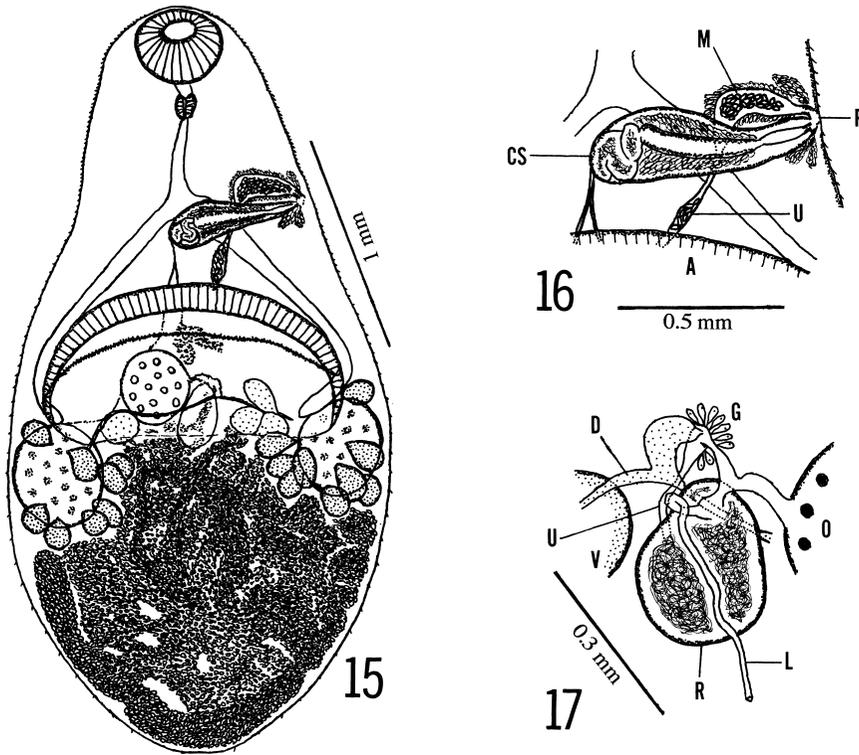
marginal or dorso-submarginal, usually bifurcal level.

Ovary almost spherical,  $0.20\text{--}0.36 \times 0.30\text{--}0.43$ , usually dextral, occasionally median, a short distance posterior to or touching acetabulum. Oviduct arising from left margin of ovary, receiving short duct from seminal receptacle, then common vitelline duct, and entering Mehlis' gland. Seminal receptacle  $0.10\text{--}0.33 \times 0.15\text{--}0.33$ , sinistral or posterosinistral to or partly overlapping ovary. Laurer's canal opening near postovarian level. Mehlis' gland sinistral to ovary (Fig. 13). Uterus filling available space of hindbody, then crossing left side or middle of acetabulum to enter metraterm. Metraterm slender, muscular,  $0.30\text{--}0.71$  long, surrounded by glandular cells. Eggs covered with two transverse bands ( $3\text{--}7\ \mu\text{m}$  thick),  $32\text{--}37 \times 14\text{--}17\ \mu\text{m}$  in egg proper (Fig. 14).

Vitellaria in two lateral groups, 9–11 (usually 9) follicles on right and 7–10 (usually 10) on left, extending from some distance posterior to acetabulum to testes. Vitellaria sometimes partly overlapping testes and ovary. Excretory vesicle I-shaped, reaching near posttesticular level.

*Remarks.* The genus *Neosteganoderma* contains three species: *N. glandulosum* Byrd, 1964, *N. polymixiae* (Yamaguti, 1970) and *N. infundibulum* (Kamegai, 1973). Of them, *N. polymixiae* was suggested by Bray & Gibson (1986) to be a synonym of *N. glandulosum*.

The present new species is most similar to *N. infundibulum* in having a funnel-shaped oral sucker, but differs from it in having a short esophagus, caeca opening through separate ani near the posterior end of the body, and eggs surrounded by two transverse bands. In *N. in-*



Figs. 15–17. *Proctophantastes nettastomatis* sp. nov.—15. Entire worm, ventral view (holotype, MPM Coll. 18374). 16. Terminal genitalia, ventral view. 17. Ovarian complex, dorsal view. Abbreviations: A, acetabulum; CS, cirrus sac; D, vitelline duct; G, Mehlis' gland; L, Laurer's canal; M, metraterm; O, ovary; P, genital pore; R, seminal receptacle; U, uterus; V, vitellarium.

*fundibulum*, the esophagus is long, dividing into esophagus proper and pseudoesophagus, the caeca terminate blindly in ovarian zone, and the eggs are normal-shaped.

***Proctophantastes nettastomatis* sp. nov.**

(Figs. 15–17)

*Material.* Four specimens from intestine of *Nettastoma parviceps* Günther (Nettastomidae), Suruga Bay, Japan, 24-X-1973 (MPM Coll. 18374, holotype & 3 paratypes), coll. Sh. Kamegai.

*Description.* Based on 4 whole-mounts. Body pyriform, 3.32–3.95 long by 1.61–1.83 wide. Tegument with fine spines. Oral sucker subterminal, spherical, 0.23–0.38×0.38–0.45; prepharynx 0.06–0.09 long; pharynx ovoid, 0.13–0.15×

0.11–0.12; esophagus straight, 0.28–0.38 long, bifurcating midway between pharynx and acetabulum; caeca slender, passing lateral sides of acetabulum and terminating almost to postacetabular level. Acetabulum much wider than long, 0.66–0.85×1.33–1.48, with equatorial division, and lacking muscular posterior margin. Sucker ratio 1:3.0–3.7. Forebody 49–55% of body length (Fig. 15).

Testes subglobular, symmetrical, just posterior to or slightly overlapping acetabulum, close to lateral body margin; right testis 0.49–0.58×0.32–0.40 and left testis 0.47–0.54×0.30–0.36. Posttesticular space 24–33% of body length. Cirrus sac claviform, straight or arcuate, 0.60–0.87×0.20–0.22, extending posteriorly some distance anterior to or touching anterior border of acetabulum; containing convoluted seminal vesicle, almost straight pars prostatica

0.34–0.37 long, prostatic cells, and cirrus 0.13–0.25 long. Genital atrium narrow, surrounded by a few bunches of glandular cells (Fig. 16). Genital pore sinistral, marginal or submarginal, at bifurcal level.

Ovary almost spherical, 0.36–0.38×0.31–0.36, right to midline, overlapping acetabulum partly or completely. Oviduct arising from anterosinistral margin of ovary, receiving short duct from seminal receptacle and common vitelline duct, then entering Mehlis' gland. Seminal receptacle subglobular, 0.25–0.33×0.16–0.22, posterosinistral to ovary. Mehlis' gland almost median, sinistral to ovary. Laurer's canal arising from anterior portion of seminal receptacle where oviduct connects, curved, running backward, opening middorsally near postovarian level (Fig. 17). Uterus filling hindbody and crossing longitudinally in middle of acetabulum to connect with metraterm. Metraterm 0.32–0.43 long, covered with glandular cells. Eggs 35–40×18–21  $\mu\text{m}$ . Vitellaria composed of two lateral fields of 9 (right) and 12–13 (left) follicles which lie around and partly overlap testes. Excretory vesicle saccate, 0.23–0.26×0.15–0.17; pore dorsal, a short distance from posterior end of body, covered with glandular cells.

*Remarks.* According to Bray (1987), the genus *Proctophantastes* contains two species: *P. abyssorum* Odhner, 1911 and *P. gillissi* (Overstreet & Pritchard, 1977).

The present new species differs from both by lacking muscular posterior margin of the acetabulum. In the acetabulum lacking muscular margin in the posterior half, the present species is similar to *Brachyenteron dextroporus* Kuramochi, 2005 from *Dysomma anguillare* (Synbranchidae) from the East China Sea, but the latter has short caeca terminating in the preacetabular zone, and a genital pore being consistently dextral.

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