

Two New Digenean Trematodes (Lepocreadiidae and Monorchiidae) from Balistid Fishes of the West Pacific

Masaaki Machida

Department of Zoology, National Museum of Nature and Science,
4–1–1, Amakubo, Tsukuba-shi, Ibaraki, 305–0005 Japan

(Received 1 August 2011; accepted 28 September 2011)

Abstract Two new digenean trematodes are described from balistid fishes of the West Pacific. *Balistovermis lombokensis* gen. et sp. nov. (Lepocreadiidae) from *Balistapus undulatus* of Indonesia is characteristic in having a transversely elongate body and caeca forming a cyclocoel. *Cableia papagot* sp. nov. (Monorchiidae) from *Balistoides viridescens* of the Philippines and from unidentified triggerfish of Japan differs from two previously known species of *Cableia* by possessing a short esophagus, an acetabulum with sphincter around the aperture, a cirrus with distinctive spines, a seminal receptacle, and eggs with a short filament.

Key words: Trematoda, Digenea, Lepocreadiidae, Monorchiidae, new genus, new species, Balistidae, Indonesia, Philippines, Japan.

Two new digenean trematodes are described from balistid fishes of the West Pacific. *Balistovermis lombokensis* gen. et sp. nov. (Lepocreadiidae) was obtained from *Balistapus undulatus* of Indonesia, and *Cableia papagot* sp. nov. (Monorchiidae) was collected from *Balistoides viridescens* of the Philippines and unidentified triggerfish of Japan.

The digeneans obtained were washed in saline, fixed in AFA under slight pressure, stained with Heidenhain's hematoxylin, cleared in creosote and mounted in Canada balsam. The specimens are deposited in the National Museum of Nature and Science (NSMT). Measurements are given in millimeters unless otherwise stated.

Family Lepocreadiidae

Balistovermis gen. nov.

Diagnosis. Body flattened, transversely elongate with notch at anterior median margin. Tegumental spines absent. Oral sucker globular, subterminal. Prepharynx not seen. Pharynx oval. Esophagus short, bifurcating near mid-forebody. Acetabulum spherical, usually a little larger than oral sucker, slightly anterior to midbody. Caeca

fine, undulating arcuate, passing some distance inside of body margin, forming cyclocoel. Testes subglobular, sometimes with incisions, symmetrical, posterolateral to acetabulum. External seminal vesicle tubular, terminating in acetabular zone. Cirrus sac claviform; containing oval internal seminal vesicle, saccular pars prostatica, and elongate cirrus. Cirrus eversible. Genital atrium shallow to deep. Genital pore sinistral to intestinal bifurcation, on or just outside of left caecum. Ovary with uneven surface, median, intertesticular, posterior to acetabulum. Seminal receptacle and Laurer's canal present. Uterus in a mass pre- to posterodextral to ovary. Vitelline follicles small, extensive, surrounding caeca except the area around suckers and gonads. Excretory vesicle saccate; pore dorsal, posterior to ovary. Parasitic in marine teleosts.

Type and only species: *Balistovermis lombokensis* sp. nov.

Remarks. *Balistovermis* closely resembles *Hypocreadium* Ozaki, 1936, but differs from it by having a transversely elongate body, and caeca that join each other and form a cyclocoel. In *Hypocreadium*, the body is broad oval-shaped,

and the caeca terminate blindly, not forming a cyclocoel.

***Balistovermis lombokensis* sp. nov.**

(Figs. 1–3)

Type host. *Balistapus undulatus* (Park) (Balistidae).

Site. Intestine.

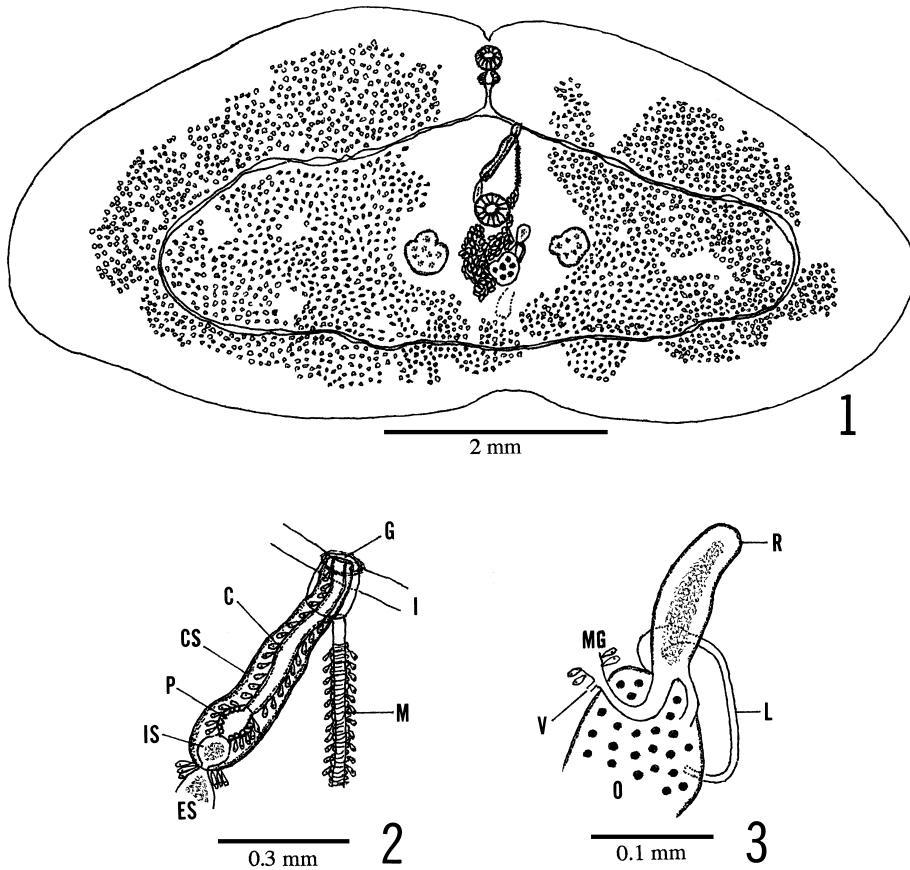
Type locality. Lombok, Indonesia; 19-I-1994.

Specimens. Holotype and 4 paratypes, NSMT-PI 5170.

Etymology. The name *Balistovermis* is derived from the generic name of the host, and *lombokensis* indicates the type locality.

Description. Eleven specimens were obtained, of them one specimen was fully gravid, four were young adults with a small number of eggs, and six were immature without eggs.

1) One fully gravid specimen (holotype) is: Body flattened, transversely elongate, 3.40 long by 7.90 wide. Body width 232% of body length. Notch present at anterior median margin. Tegumental spines not seen. Oral sucker subterminal, globular, 0.23×0.25 ; prepharynx unrecognizable; pharynx 0.13×0.19 , bifurcating slightly anterior to middle of forebody; caeca fine, undulating arcuate, passing some distance inside of body margin, forming cyclocoel. Acetabulum globular, 0.31×0.30 . Sucker ratio 1 : 1.2. Forebody 45% of



Figs. 1–3. *Balistovermis lombokensis* gen. et sp. nov. — 1, Entire worm, ventral view (holotype, NSMT-PI 5170); 2, terminal genitalia, ventral view; 3, ovarian complex, ventral view (based on immature specimen). Abbreviations: C, cirrus; CS, cirrus sac; ES, external seminal vesicle; G, genital pore; I, caecum; IS, internal seminal vesicle; L, Laurer's canal; M, metraterm; MG, Mehlis' gland; O, ovary; P, pars prostatica; R, seminal receptacle; V, common vitelline duct.

body length.

Testes subglobular, with two or three incisions, symmetrical, posterolateral to acetabulum; right testis 0.40×0.41 ; left testis 0.40×0.38 . Cirrus sac claviform, 0.45×0.13 , diagonal, extending posteriorly a short distance anterior to acetabulum; containing oval internal seminal vesicle 0.07×0.08 , vesicular pars prostatica 0.09×0.08 and eversible cirrus 0.44 long. A small number of glandular cells surrounding proximal end of cirrus sac. External seminal vesicle tubular, 0.56×0.09 , terminating in acetabular zone. Genital atrium rather deep. Genital pore sinistral to intestinal bifurcation, immediately outside of left caecum.

Ovary subglobular with uneven surface, 0.33×0.28 , median, intertesticular, posterior to acetabulum. Oviduct arising from anterior corner of ovary, giving off Laurer's canal at the same point where the posterior end of seminal receptacle is connected, running posterolaterally, joining common vitelline duct, entering Mehlis' gland. Laurer's canal opening dorsally in posterior portion of ovary. Seminal receptacle saccate, 0.22×0.12 , anterosinistral to ovary. Uterus in a mass, between acetabulum and ovary, dextral and posterodextral to ovary. Eggs $71-74 \times 48-54 \mu\text{m}$. Metraterm thick-walled, 0.40 long, surrounded by glandular cells, sinistral to cirrus sac. Vitelline follicles small, numerous, widely distributed in both sides of caeca except the area around suckers and gonads. Excretory pore dorsal, median, midway between ovary and posterior caecum; vesicle saccate, reaching to ovary.

2) Four young adult specimens with a small number of eggs (paratypes) are: Body 2.13–2.60 long by 3.03–4.80 wide. Body width 122–186% of body length. Oral sucker $0.17-0.20 \times 0.15-0.22$; pharynx $0.09-0.12 \times 0.12-0.14$; esophagus $0.09-0.22$ long. Acetabulum $0.20-0.24 \times 0.20-0.23$. Sucker ratio 1 : 0.9–1.3. Forebody 40–46% of body length. Right testis $0.21-0.30 \times 0.17-0.24$; left testis $0.22-0.30 \times 0.18-0.25$. Cirrus sac $0.28-0.33 \times 0.09-0.11$. Ovary $0.21-0.25 \times 0.15-0.20$. Seminal receptacle $0.14-0.18 \times 0.07-0.09$. Eggs $73-79 \times 48-54 \mu\text{m}$.

3) Six immature specimens without eggs are:

Body 1.90–2.35 long by 2.57–3.08 wide. Body width 121–162% of body length. Oral sucker $0.16-0.19 \times 0.14-0.17$; pharynx $0.08-0.10 \times 0.10-0.12$; esophagus $0.09-0.12$ long. Acetabulum $0.16-0.21 \times 0.16-0.19$. Sucker ratio 1 : 1.1–1.2. Forebody 41–45% of body length. Right testis $0.17-0.20 \times 0.12-0.18$; left testis $0.19-0.25 \times 0.12-0.19$. Cirrus sac $0.17-0.24 \times 0.07-0.09$. Ovary $0.15-0.19 \times 0.10-0.15$.

Remarks. The present new species closely resembles the members of *Hypocreadium* Ozaki, 1936 in arrangement of gonads, structure of excretory vesicle, etc., but differs from them by having a transversely elongate body and caeca forming a cyclocoel (Ozaki, 1936; Bray and Cribb, 1996; Bray, 2005). As described above, the body gradually widens transversely with growth and the width reaches 232% of the length. The caeca curve widely and vitelline follicles spread sideways. The members of *Hypocreadium* possess caeca terminating blindly, not joining each other. The present new species is characteristic in having caeca that join each other and form a cyclocoel.

Family Monorchiidae

Cableia papagot sp. nov.

(Figs. 4–7)

Type host. *Balistoides viridescens* (Bloch et Schneider) (Balistidae).

Other host. Unidentified triggerfish (Balistidae).

Site. Intestine.

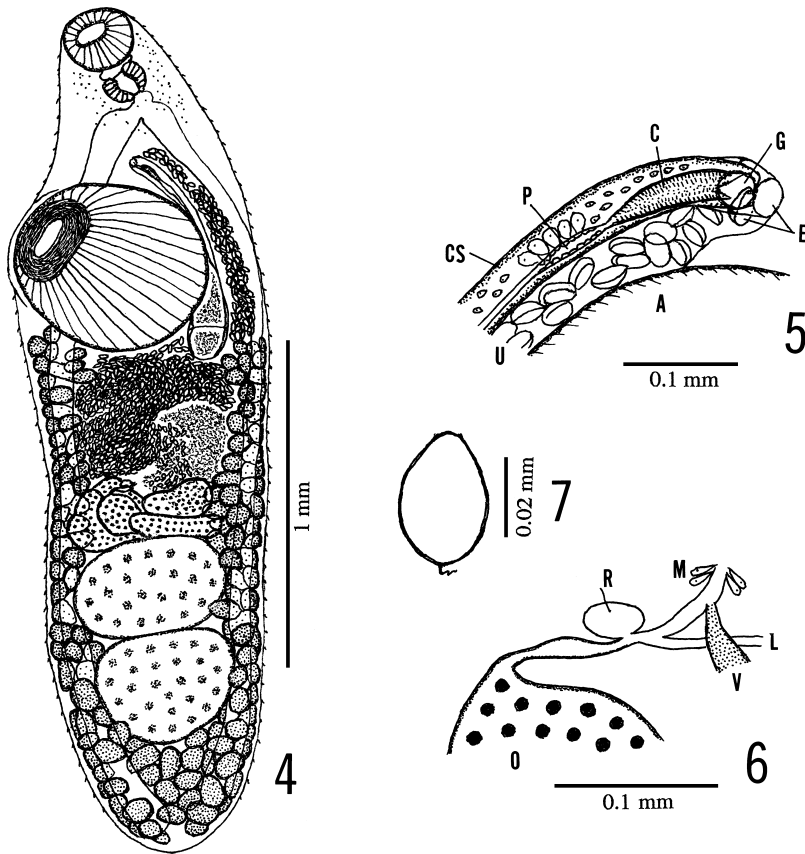
Type locality. Palawan, the Philippines; 17-XI-1988.

Other locality. Ishigaki-jima, Okinawa Pref., Japan; 23-II-1973.

Specimens. Holotype, NSMT-PI 3596 and 3 paratypes, NSMT-PI 1262b and 3596.

Etymology. The specific name *papagot* is from the Philippine local name of the host.

Description. Based on four specimens. Body elongate, more broadly rounded posteriorly than anteriorly, 2.30–3.03 long by 0.67–0.78 wide at



Figs. 4–7. *Cableia papagot* sp. nov. — 4, Entire worm, ventral view (holotype, NSMT-PI 3596); 5, terminal genitalia, ventral view; 6, ovarian complex, ventral view; 7, egg (oval type). Abbreviations: A, acetabulum; C, cirrus; CS, cirrus sac; E, egg; G, genital pore; L, Laurer's canal; M, Mehlis' gland; P, pars prostatica; R, seminal receptacle; U, uterus; V, common vitelline duct.

acetabular level. Tegument spinose. Pigment granules scattered in forebody. Oral sucker $0.16\text{--}0.22 \times 0.21\text{--}0.28$; prepharynx $0.04\text{--}0.09$ long; pharynx $0.08\text{--}0.10 \times 0.11\text{--}0.20$; esophagus very short, $15\text{--}30\ \mu\text{m}$ long, bifurcating nearer oral sucker than acetabulum; caeca extending near posterior end of body. Acetabulum well-developed, $0.52\text{--}0.61 \times 0.46\text{--}0.57$, with circular sphincter around the aperture. Sucker ratio 1: 2.0–2.4. Forebody 29–33% of body length.

Testes globular or subglobular, sometimes one or two incisions on lateral margin, tandem, contiguous, in posterior half of hindbody; anterior testis $0.23\text{--}0.33 \times 0.41\text{--}0.54$; posterior testis $0.35\text{--}0.43 \times 0.39\text{--}0.48$. Posttesticular space 11–14% of body length. Cirrus sac slender, nearly

straight, $0.71\text{--}1.00 \times 0.10\text{--}0.13$, extending slightly posterior to acetabulum or about anterior 1/3 between acetabulum and ovary; containing bipartite seminal vesicle, anterior portion of the vesicle narrowing distally; pars prostatica $55\text{--}85\ \mu\text{m}$ long, with round prostatic cells; cirrus $85\text{--}120\ \mu\text{m}$ long which is completely lined with spines $5\text{--}8\ \mu\text{m}$ long. Distal end of cirrus protruding into genital atrium. Genital atrium shallow, unarmed. Genital pore median or submedian, midway between intestinal bifurcation and acetabulum.

Ovary wider than long, maybe five-lobed, $0.15\text{--}0.21 \times 0.41\text{--}0.51$ as a whole, near midlevel of hindbody, in contact with anterior testis. Oviduct arising from anterodextral corner of ovary, connecting small seminal receptacle

17–25×40–50 µm just before dividing Laurer's canal, receiving common vitelline duct, entering Mehlis' gland. Laurer's canal opening middorsally near anterior border of ovary. Mehlis' gland immediately anterior to ovary. Uterus voluminous, between ovary and acetabulum, then upward along cirrus sac; metraterm indistinct. Proximal end of uterus filled with sperm. Of the four specimens, two specimens have oval eggs 31–35×20–22 µm; the other two have rather slender eggs 35–39×18–22 µm; both with a short curly filament at antiopercular end. Vitelline follicles extending from postacetabular level to posterior end of body, confluent in posttesticular space. Excretory vesicle tubular, anterior extent not determined; pore terminal.

Remarks. Two other species of *Cableia* have been described: *Cableia trigoni* Sogandares-Bernal, 1959 (type species) from the ostraciid fish *Lactophrys trigonus* from Bimini, the West Indies, and *C. pudica* Bray, Cribb et Barker, 1996 from the monacanthid fishes *Cantheschenia grandisquamis*, *Cantherhines pardalis*, *C. dumerili* and *Pervagor janthinosoma* from the Great Barrier Reef. The present new species differs from both by possessing a short esophagus, an acetabulum with sphincter around the aperture, a cirrus with distinctive spines, a seminal receptacle, and eggs with a short filament.

Cableia was originally placed in the family Lepocreadiidae, was moved to the Opecoelidae, Enenteridae and quite recently the Acanthocolpidae (Sogandares-Bernal, 1959; Yamaguti, 1971; Gibson and Bray, 1982; Bray *et al.*, 1996). At present, molecular evidence supports *Cableia* to be neither a lepecreadiid, opecoelid, enenterid nor acanthocolpid, but a monorchiid, though the two previously known species of *Cableia* do not fit the current morphological concept of the Monorchiidae (Cribb *et al.*, 2001; Olson *et al.*, 2003; Bray *et al.*, 2005). The present new species seems to be morphologically closer to the Monorchiidae than the two other species of *Cableia* in having a male terminal genitalia (an ejaculatory duct and/or a cirrus) with distinctive spines, and a small seminal receptacle attached to

the oviduct. Sogandares-Bernal (1959) did not mention the spinose cirrus in *Cableia trigoni*, but Yamaguti (1971) reexamined Sogandares-Bernal's specimen and found the everted cirrus to be covered with fine spines. Bray *et al.* (1996) described and illustrated the ejaculatory duct in *C. pudica* as being muscular and unspined. No seminal receptacle was observed in both *C. trigoni* and *C. pudica* (Yamaguti, 1971; Bray *et al.*, 1996). The filamented eggs in the present species may be another feature linking *Cableia* with the Monorchiidae.

References

- Bray, R. A. 2005. Family Lepocreadiidae Ochner, 1905. In Jones, A., R. A. Bray and D. I. Gibson (eds.): Keys to the Trematoda, Vol. 2, pp. 545–602. CAB International and Natural History Museum, London.
- Bray, R. A. and T. H. Cribb 1996. The Australian species of *Lobatocreadium* Madhavi, 1972, *Hypocreadium* Ozaki, 1936 and *Dermadena* Manter, 1945 (Digenea: Lepocreadiidae), parasites of marine tetraodontiform fishes. *Systematic Parasitology*, 35: 217–236.
- Bray, R. A., T. H. Cribb and S. C. Barker 1996. *Cableia pudica* n. sp. (Digenea: Acanthocolpidae) from monacanthid fishes of the southern Great Barrier Reef, Australia. *Parasite*, 3: 49–54.
- Bray, R. A., B. L. Webster, P. Bartoli and D. T. J. Littlewood 2005. Relationships within the Acanthocolpidae Lühe, 1906 and their place among the Digenea. *Acta Parasitologica*, 50: 281–291.
- Cribb, T. H., R. A. Bray, D. T. J. Littlewood, S. P. Pichelin and E. A. Herniou 2001. The Digenea. In Littlewood, D. T. J. and R. A. Bray (eds.): Interrelationships of the Platyhelminthes, pp. 168–185. Taylor and Francis, London.
- Gibson, D. I. and R. A. Bray 1982. A study and reorganization of *Plagioporus* Stafford, 1904 (Digenea: Opecoelidae) and related genera, with special reference to forms from European Atlantic waters. *Journal of Natural History*, 16: 529–559.
- Olson, P. D., T. H. Cribb, V. V. Tkach, R. A. Bray and D. T. J. Littlewood 2003. Phylogeny and classification of the Digenea (Platyhelminthes: Trematoda). *International Journal for Parasitology*, 33: 733–755.
- Ozaki, Y. 1936. Two new genera of the Trematoda family Allocreadiidae. *Zoological Magazine*, 48: 513–518, pl. XVI.
- Sogandares-Bernal, F. 1959. Digenetic trematodes of marine fishes from the Gulf of Panama and Bimini, British West Indies. *Tulane Studies in Zoology*, 7: 69–117.
- Yamaguti, S. 1971. Synopsis of Digenetic Trematodes of Vertebrates. 1074 pp, 349 pls., Keigaku Publ., Tokyo.