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Allocreadium tamoroko sp. nov. (Digenea, Allocreadiidae) Parasitic in the Intestine of the Freshwater Fish *Gnathopogon elongatus elongatus* (Cyprinidae) from Shiga Prefecture, Central Japan

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Abstract *Allocreadium tamoroko* sp. nov. (Digenea, Allocreadiidae) is described and figured from the intestine of the freshwater fish *Gnathopogon elongatus elongatus* (Temminck and Schlegel, 1846) (Cyprinidae) from the Kayao River, which belongs to the Lake Biwa basin, at Nakano, Otsu City, Shiga Prefecture, central Japan. This new species is distinctively characterized by a long esophagus reaching to the posterior border of the ventral sucker, a large ventral sucker with the sucker width ratio of 1 : 1.8, a large cirrus pouch extending backward to the posterior border of the ventral sucker, and a large internally warty metraterm reaching to the posterior border of the ventral sucker.

Key words : *Allocreadium tamoroko* sp. nov., Digenea, *Gnathopogon elongatus elongatus*, Lake Biwa basin, central Japan.

Introduction

Species of *Allocreadium* Looss, 1900 (Digenea, Alllocreadiidae) are parasitic in the intestine of freshwater fishes of Asia, Europe, Africa, and North America (Caira and Bogéa, 2005). In Japan, eight nominal species and six unidentified species of *Allocreadium* have previously been known (Shimazu, 1988, 1992, 2003a, 2003b, 2005, 2008; Shimazu and Hashimoto, 1999; Shimazu *et al.*, 2011) as will be shown below. Shimazu *et al.* (2011) compiled information into a monograph on adult digeneans of freshwater fishes from the Lake Biwa basin in Shiga Prefecture, central Japan, from the existing specimens including theirs and literature and recorded three previously known species and two unidentified species of *Allocreadium*. We add a new species of *Allocreadium* to the Lake Biwa basin in this paper.

Materials and Methods

Specimens were slightly flattened, fixed in 70% ethanol, stained with alum carmine, and mounted in Canada balsam. They have been deposited in the National Museum of Nature and Science (NMNS, collection name code NSMT-Pl), Tsukuba, Ibaraki Prefecture, Japan. Drawings were made with the aid of a camera lucida. Measurements (length by width) are given in millimeters unless otherwise stated.

Allocreadium tamoroko sp. nov.

Type host. *Gnathopogon elongatus elongatus* (Temminck and Schlegel, 1846) (Cyprinidae) (Japanese name: Ta-moroko).

Site of infection. Intestine.

Type locality. Kayao River at Nakano (34°57′N, 135°57′E), Otsu City, Shiga Prefecture.

Prevalence of infection. Two worms in 1 of

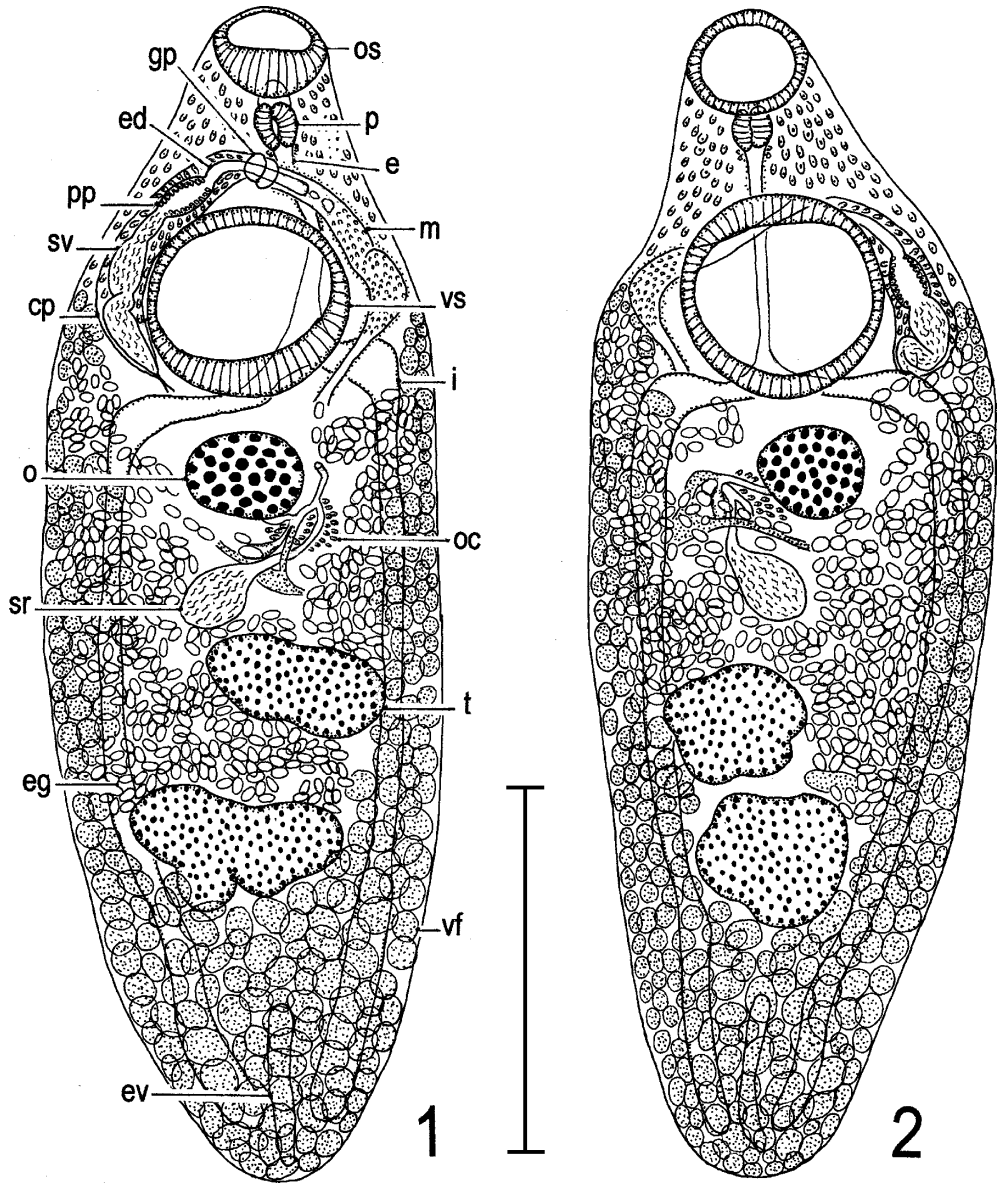
13 fish (43–65 mm FL) examined on 1 May 2009.

Type specimens. Holotype and 1 paratype (NSMT-Pl 5858): slightly flattened, whole-mounted, adult specimens.

Etymology. The specific name *tamoroko*, a noun in apposition, is derived from the Japanese name of the type host fish.

Description (Figs. 1–2). Body fairly small, elongate, 4.71–4.73 by 1.59–1.63 (holotype 4.73 by 1.59); forebody rapidly tapering anteriorly, 1.11–1.19 long, occupying 23–25% of body length, with many gland cells. Tegument smooth. Eyespot pigment fine. Oral sucker subglobular, subterminal, 0.36–0.42 by 0.46–0.47. Prepharynx short. Pharynx elliptical, 0.20–0.23 by 0.15–0.16. Esophagus 0.76–0.89 long, bifurcating at posterior border of ventral sucker. Intestines terminating blindly near posterior extremity of body. Ventral sucker large, globular, 0.78–0.80 by 0.82–0.84, located at about junction of anterior and second fourths of body; sucker width ratio 1 : 1.8. Testes two, large, weakly indented irregularly, anterior testis slightly smaller than posterior, 0.35–0.51 by 0.57–0.84, a little oblique, separate, in middle third of hindbody. Seminal vesicle long, sinuous, 0.32–0.38 long. Pars prostatica large, elliptical, 0.19–0.22 by 0.14, surrounded by small prostatic cells. Ejaculatory duct long, slightly everted into metraterm in the holotype, surrounded by gland cells. Cirrus pouch large, clavate, 0.84–1.27 by 0.17–0.22, enclosing seminal vesicle, prostatic complex, and ejaculatory duct, extending backward to posterior border of ventral sucker. Genital atrium small. Genital pore shifted a little to right or left of median line of body, located at esophageal level, near pharynx in the holotype, but not clearly observed (may open in contact with anterior border of ventral sucker) in the paratype. Ovary smaller than testes, transversely elliptical to globular, 0.35–0.38 by 0.44–0.47, median, slightly posterior to ventral sucker. Ovarian complex posterolateral to ovary. Laurer's canal short, running forward or backward. Seminal receptacle elliptical, 0.32 by 0.23–0.25, with long duct. Ootype large, vesicular, between ovary and seminal receptacle; Mehlis' gland well developed. Uterus coiled between anterior border of posterior testis and ventral sucker, overlapping intestines and vitelline follicles; metraterm large, clavate, 0.76–0.92 by 0.14–0.16, internally warty. Eggs numerous, ovate, operculate at narrower pole, yellow, 71–83 by 44–59 μm, not embryonated. Vitelline follicles distributed from middle level of ventral sucker (or level slightly anterior to intestinal bifurcation) to posterior extremity of body, overlapping intestines, separate anteriorly, confluent in post-testicular region of body. Excretory vesicle I-shaped, reaching anteriorly to middle of post-testicular region; excretory pore dorsal, near posterior extremity of body.

Discussion. The following eight nominal species of *Allocreadium* have previously been known from Japan: *Allocreadium gotoi* (Hasegawa and Ozaki, 1926), *Allocreadium hasu* Ozaki, 1926, *Allocreadium japonicum* Ozaki, 1926, *Allocreadium tosai* Shimazu, 1988, *Allocreadium brevivitellatum* Shimazu, 1992, *Allocreadium tribolodontis* Shimazu and Hashimoto, 1999, *Allocreadium shinanoense* Shimazu, 2003, and *Allocreadium aburahaya* Shimazu, 2003 (Shimazu, 1988, 1992, 2003a; Shimazu and Hashimoto, 1999). The following three of them have previously been recorded from the Lake Biwa basin: *A. gotoi* from *Misgurnus anguillicaudatus* (Cantor, 1842) (Cobitidae) and *G. elongatus elongatus*; *A. hasu* from *Opsariichthys uncirostris uncirostris* (Temminck and Schlegel, 1846) (Cyprinidae), *G. elongatus elongatus,* and *Zacco platypus* (Temminck and Schlegel, 1846) (Cyprinidae); and *A. japonicum* from *Z. platypus*, *Zacco temminckii* (Temminck and Schlegel, 1846) [as *Nipponocypris temminckii* (Temminck and Schlegel, 1846)], *Rhynchocypris oxycephalus* (Sauvage and Dabry de Thiersant, 1874) (Cyprinidae), and *Gasterosteus aculeatus leiurus* Cuvier, 1829 (Gasterosteidae) (Shimazu *et al.*, 2011). *Allocreadium tamoroko* sp. nov. differs from all of the eight species in having a long esophagus reaching to the posterior border of the ventral sucker, a large ventral sucker with the



Figs. 1–2. *Allocreadium tamoroko* sp. nov. found in the intestine of *Gnathopogon elongatus elongatus*. —— 1, holotype (NSMT-Pl 5858), entire body, ventral view; 2, paratype (NSMT-Pl 5858), entire body, ventral view. Scale bar: 1 mm. cp, cirrus pouch; e, esophagus; ed, ejaculatory duct; eg, eggs in uterus; ev, excretory vesicle; gp, genital pore; i, intestine; m, metraterm; o, ovary; oc, ovarian complex; os, oral sucker; p, pharynx; pp, pars prostatica; sr, seminal receptacle; sv, seminal vesicle; t, testis; vf, vitelline follicles; vs, ventral sucker.

sucker width ratio of 1 : 1.8, a large cirrus pouch extending backward to the posterior border of the ventral sucker, and a large internally warty metraterm reaching to the posterior border of the ventral sucker. Further, this new species is also different from an unidentified species, *Allocreadium* sp. of Shimazu *et al.*, 2011, from *Tanakia lanceolata* (Temminck and Schlegel, 1846) (Cyprinidae) from the Lake Biwa basin (Shimazu *et al.*, 2011) mainly in the above-mentioned fea-

tures. An unidentified species, *Allocreadium* sp. of Kataoka and Momma, 1934, has previously been reported from *Plecoglossus altivelis altivelis* (Temminck and Schlegel, 1846) (Plecoglossidae) from the Lake Biwa basin (Kataoka and Momma, 1934; Shimazu, 1899); but Shimazu (1899) treated it as an *incertae sedis*. The new species somewhat resembles an unidentified species, *Allocreadium* sp. of Shimazu, 2008, found in *Z. temminckii* from the Kaifu River in Tokushima Prefecture (Shimazu, 2008) in having a long esophagus, a large ventral sucker, and a large cirrus pouch; but it is separated from the latter by a lower sucker width ratio (1 : 1.8 instead of 1 : 2.35). The ventral sucker is also large with the sucker ratio of 1: about 2.0 in *A. transversale* (Rudolphi, 1802) Odhner, 1901 from Europe and *A. kamalai* Gupta, 1956 and *A. mehrai* Gupta, 1956 from India (Szidat, 1938; Gupta, 1956). However, the new species is distinguished from these species by having a much longer esophagus and an almost prebifurcal ventral sucker and possibly by the biogeographical distribution.

Later, we examined 33 fish (38–92 mm FL) of *G. elongatus elongatus* collected in the Kayao River on 6 December 2009, 22–23 May 2010, and 16 October 2010; but no worms of the new species were obtained from them.

Life cycle. Not known.

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