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***Clinostomum complanatum* (Trematoda: Clinostomatidae) in Five New Fish Hosts in Japan**

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ABSTRACT: Metacercariae of *Clinostomum complanatum* were found in six species of natural freshwater fishes collected at Koyama Pond in Tottori City of Tottori Prefecture, Japan. Five of these fish species are reported here as new records for second intermediate hosts of *C. complanatum* in Japan: the silver crucian carp (*Carassius gibelio langsdorfi*), the deep-bodied crucian carp (*Carassius cuvieri*), the carp (*Cyprinus carpio*), the topmouth gudgeon (*Pseudorasbora parva*) and the rose bitterling (*Rhodeus ocelatus*).

Key words: *Clinostomum complanatum*, natural infection, fishes, second intermediate host, Japan.

Clinostomum complanatum (Rudolphi, 1814) occurs in Europe, North America, the Near East and Asia (Nigrelli, 1936; Grabda-Kazubska, 1974; Lo et al., 1982; Kalantan et al., 1985). The metacercariae, often referred to as "yellow grubs," have been found in many species of freshwater fish in North America (Nigrelli, 1936). In contrast, this parasite is known from only four species of freshwater fish from Japan: the crucian carp (*Carassius carassius*), the slender bitterling (*Rhodeus lanceolatus*), the Asian pond loach (*Cobitis anguillicaudatus*), and the pike gudgeon (*Pseudogobio esocinus*) (Yamaguti, 1933; Kagei et al., 1984).

Clinostomum complanatum was the causative agent in four of the nine human cases of *Clinostomum* infection reported in Japan; infected fish may have been eaten by the humans (Yamashita, 1938; Hirai et al., 1987; Umegai et al., 1990; Yoshimura et al., 1991).

Our objective was to identify additional second intermediate hosts for *C. complanatum* among fish in Japan.

We examined 1,860 freshwater fish of

14 species for *Clinostomum* infections in Koyama Pond in Tottori City (35°30'N, 134°10'E) from September 1988 to November 1990. Each unruptured cyst was removed from the fish and measured under a dissecting microscope. Metacercariae were freed from fish tissue by exposing them for 10 min at 37 C to an artificial gastric juice composed of 1 g pepsin in 1 l of distilled water, adjusted to pH 1.3 with 36% HCl. Most excysted metacercariae were fixed in 70% ethyl alcohol under a cover glass and stained with Borax-carmin. Seven metacercariae were inoculated into 6- to 8-day-old chicken eggs to obtain adult flukes by the method of Fried and Foley (1970). Chicken eggs were examined for adult flukes 5 days after inoculation.

Six of 14 fish species examined carried *Clinostomum* metacercariae (Table 1). Of these, five fish species are reported for the first time as second intermediate hosts of this parasite (Table 1).

The cysts usually were yellow in color and spherical or elliptical in shape. They ranged in size from 0.65 to 2.90 mm long, and 0.65 to 2.30 mm wide. Mean values (SD) were 2.02 (0.44) mm long by 1.54 (0.41) mm wide. There were no apparent differences in the morphological features and sizes among the metacercariae from different fish host species.

Three of the trematodes recovered from chicken eggs contained eggs in their uteri. The morphological characteristics of the trematodes agreed with those described by Yamaguti (1933).

All of the fish were collected from Koyama Pond. Many species of wild birds inhabit this pond; herons are the most com-

TABLE 1. Prevalence and intensity of metacercarial infection of *Clinostomum complanatum* in freshwater fishes, collected at Koyama Pond in Tottori City of Tottori Prefecture, Japan.

Species of fishes	Number of fish		Intensity	
	Examined	Infected (%)	Mean (SD)	Range
<i>Carassius gibelio langsdorfi</i> (silver crucian carp)*	378	114 (30.2)	3.4 (6.5)	1-60
<i>Carassius cuvieri</i> (deepbodied crucian carp)*	41	18 (43.9)	10.2 (20.7)	1-77
<i>Cyprinus carpio</i> (carp)*	110	31 (28.2)	9.8 (19.8)	1-106
<i>Pseudorasbora parva</i> (topmouth gudgeon)*	134	9 (6.7)	1.4 (0.7)	1-3
<i>Rhodeus ocellatus</i> (rose bitterling)*	233	2 (0.9)	1	1
<i>Rhodeus lanceolatus</i> (slender bitterling)	529	53 (10.0)	2.4 (2.7)	1-14
<i>Hypomesus transpacificus</i> (Japanese smelt)	220	0		
<i>Salangichthys microdon</i> (Japanese icefish)	106	0		
<i>Cobitis biwae</i> (sand loach)	40	0		
<i>Silurus asotus</i> (far eastern catfish)	25	0		
<i>Leuciscus hakonensis</i> (Japanese dace)	20	0		
<i>Ischikauia steenackeri</i> (lakeweed chub)	12	0		
<i>Zacco platypus</i> (pale chub)	8	0		
<i>Gnathopogon elongatus elongatus</i> (field gudgeon)	4	0		

* New second intermediate host of *Clinostomum complanatum* in Japan.

mon birds. Four species of herons serve as definitive hosts of *C. complanatum* in the eastern part of Tottori Prefecture which includes Koyama Pond (Aohagi, unpubl. data).

In this study, we extended the host range of *C. complanatum* in Japan. Three of the infected freshwater fish, *Carassius gibelio langsdorfi*, *Carassius cuvieri* and *Cyprinus carpio*, are economically important. They occasionally are caught at Koyama pond by local inhabitants and eaten raw. The risks of human infection through eating raw fish in this region of Japan are clarified in this study.

Representative parasite specimens were deposited in the Laboratory Animal Research Center, Tottori University School of Medicine, Japan (Accession numbers CMCAC0001-CMRHO0002).

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