

TREMATODE INFECTION RATES OF FISH FROM A WASTEWATER TREATMENT FACTORY POLISHING POND AND A CANAL IN PHUKET, THAILAND

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Abstract. The infection rates of trematode metacercariae were studied in fish from a polishing pond of a wastewater treatment factory and from Bang Yai Canal, Mueang District, Phuket Province, Thailand. The investigation was carried out from April 2001 to April 2002. Nile tilapia (*Tilapia nilotica*) were collected from the polishing pond, while mullet (*Valamugil cunnesius*) were collected from Bang Yai Canal. The metacercariae were examined from the fish's dorsal fins, pectoral fins, ventral fins, digestive tracts, and gills. One hundred and twenty-eight Nile tilapia were collected and seven were found infected with metacercariae (5.5%). One hundred and thirty-one mullet were collected and 128 were infected with the parasites (97.7%). In the Nile tilapia, the metacercariae were found from the dorsal fins, pectoral fins, and gills at 3 (42.9%), 3 (42.9%), and 1 (14.3%) cysts, respectively. For the mullet, the metacercariae were found from the dorsal fins, pectoral fins, ventral fins, digestive tracts, and gills at 1,887 (42.4%), 339 (7.6%), 329 (7.4%), 869 (19.5%), and 1,031 (23.1%) cysts, respectively. One-way ANOVA tests (F test) were used to compare the infections of trematode metacercariae statistically. It was found that the infection rates of metacercariae at different months exhibited significant differences ($p < 0.05$), whereas the number of metacercariae found at different parts of the fish samples were not significantly different ($p > 0.05$).

INTRODUCTION

Trematode infections are public health and veterinary problems that have been reported over a wide range of areas in Thailand (Saenphet *et al*, 2001). It is well known that freshwater and brackish water fish are not only a major protein source for humans but also common intermediate hosts of many kinds of trematode parasites, such as small intestinal flukes and liver flukes (Pearson and Ow Yang, 1982; WHO, 1995; Radomyos *et al*, 1998; Sukontason *et al*, 1998). In a previous study, trematode metacercariae were reported to occur in freshwater fish from northern and northeastern Thailand (Manning *et al*, 1971; Radomyos *et al*, 1983; Namue *et al*, 1998). Since there was no report concerning trematode infection in the southern part, studies of helminthic infections in rats, cats, dogs, and even humans should be done in this region, especially surveys for larval stages in fish intermediate hosts. Thus, in this study, trematode metacercariae were investigated in fish from a polishing pond of a wastewater treatment factory and from Bang Yai Canal, Mueang District, Phuket Province, Thailand. The study results can be used as a public health and veterinary knowledge base.

MATERIALS AND METHODS

The investigation was carried out from April 2001-April 2002. Nile tilapia (*Tilapia nilotica*) (Fig 1) were collected from the polishing pond of a wastewater treatment factory, while mullet (*Valamugil cunnesius*) (Fig 2) were collected from Bang Yai Canal. The metacercariae were examined from the fish's dorsal fins, pectoral fins, ventral fins, digestive tracts, and gills. They were individually examined under stereomicroscope and photographed. The statistically significant differences in infection rates of metacercariae at different months and parts of the fish samples were studied by one-way ANOVA tests (F test).

RESULTS

One hundred and twenty-eight Nile tilapia were collected and seven were found infected with metacercariae (5.5%) (Table 1). One hundred and thirty-one mullet were collected and 128 were infected with the parasites (97.7%).

The metacercariae were investigated from muscle under the dorsal fins, pectoral fins, ventral fins, digestive tracts, and gills. In the Nile tilapia, the metacercariae were found from the dorsal fins, pectoral fins, and gills at 3 (42.9%), 3 (42.9%), and 1 (14.3%) cysts, respectively. Cysts were spherical, 280 x 300 μ m, with thick double walls. The only shape of the

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Fig 1- Nile tilapia (*Tilapia nilotica*) from the polishing pond of a wastewater treatment factory.



Fig 2- Longarm mullet (*Valamugil cunnesius*) collected from Bang Yai Canal.

Table 1
Number of metacercaria infections in Nile tilapia (*Tilapia nilotica*), April 2001-April 2002.

Month / year	No. of examinations	No. of infections	No. of metacercariae					No. of metacercariae
			Dorsal fin and muscle	Pectoral fin and muscle	Ventral fin and muscle	Digestive tract	Gill	
Apr 2001	1	0	0	0	0	0	0	0
May 2001	10	1	1	0	0	0	0	1
Jun 2001	10	0	0	0	0	0	0	0
Jul 2001	15	1	0	1	0	0	0	1
Aug 2001	10	1	1	0	0	0	0	1
Sept 2001	10	0	0	0	0	0	0	0
Oct 2001	10	1	0	1	0	0	0	1
Nov 2001	9	1	0	1	0	0	0	1
Dec 2001	11	1	1	0	0	0	0	1
Jan 2002	12	1	0	0	0	0	1	1
Feb 2002	10	0	0	0	0	0	0	0
Mar 2002	10	0	0	0	0	0	0	0
Apr 2002	10	0	0	0	0	0	0	0
Total (%)	128 (100.0)	7 (5.5)	3 (42.9)	3 (42.9)	0	0	1 (14.3)	7 (100.0)

metacercaria found in the Nile tilapia was spherical with double walls, and the larvae in the cyst were not visible (Fig 3). For the mullet, the metacercariae were found from the dorsal fins, pectoral fins, ventral fins, digestive tracts, and gills, at 1,887 (42.4%), 339 (7.6%), 329 (7.4%), 869 (19.5%), and 1,031 (23.1%) cysts, respectively. The metacercaria found in the mullet varied in shape and size. Some were spherical in shape and quite large (about 600 x 700 μm), and others have elliptical shapes (about 500 x 650 μm). The metacercaria had double walls, the outer of which was thin while the inner was rather thick. Larvae were found inside the cyst (Figs 4, 5). One-way ANOVA tests

(F test) were used to compare the infections of trematode metacercariae statistically. It was found that the infection rates of metacercariae at different months exhibited significant differences ($p < 0.05$), whereas the numbers of metacercariae found at different parts of the fish samples were not significantly different ($p > 0.05$).

DISCUSSION

The infection rates of trematode metacercariae were studied in the fish collected from a wastewater treatment factory's polishing pond and from Bang Yai

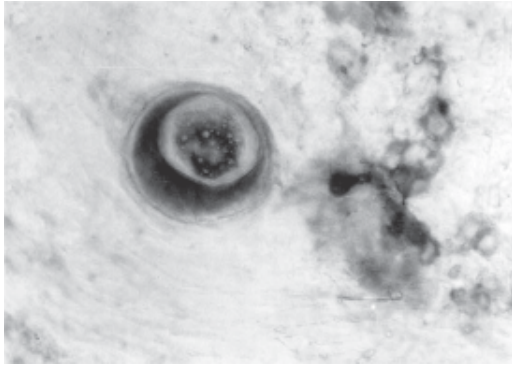


Fig 3- Metacercaria found in the muscle under the dorsal fin of a Nile tilapia.

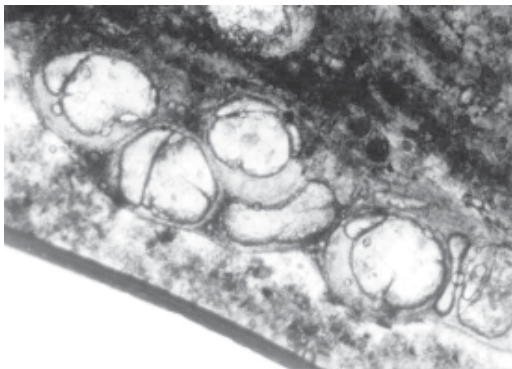


Fig 4- Metacercariae found in the digestive tract of a mullet.

Canal, Mueang District, Phuket Province, Thailand. The fish samples collected from the two water sources were of two different types. The fish found in the polishing pond were Nile tilapia which were bred, freshwater fish, whereas those found in the canal were mullet, natural, brackish-water fish. The mouth of Bang Yai Canal, highly influenced by sea water, is where the treated water from the wastewater treatment factory is discharged.

The study result showed that the Nile tilapia found in the polishing pond were infected by trematode parasites all year round, but the infection rates were very low. This is probably because the wastewater's treatment factory's polishing pond was well maintained and thus unlikely to be contaminated by natural pollutants. The parasite eggs may have come from the wastewater and survived the treatment process to the polishing pond. Growing within a snail intermediate host, the trematode continued its life cycle in Nile tilapia. It is also possible that the parasites may have come from the droppings of birds around the polishing pond. In the case of Bang Yai Canal, the

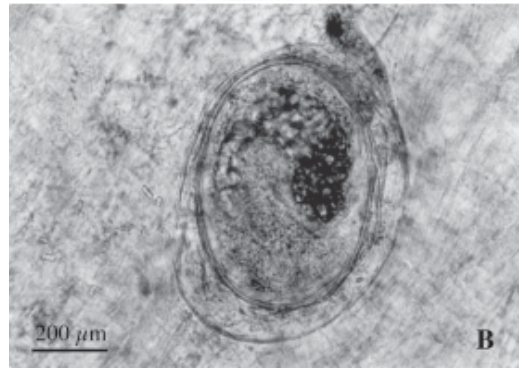
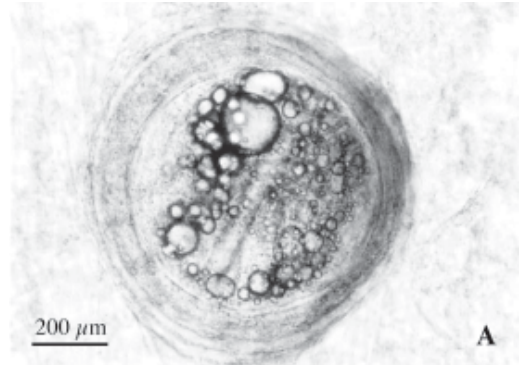


Fig 5- Metacercaria found in the muscle under the dorsal fin of a mullet.

sampled mullet were infected by trematode parasites with an extremely high infection rate of 97.7%, and were also infected by several other parasites, indicating high risk of infection in the environment which includes local people, fish-eating birds, and large fish.

In this study, the morphology of the larvae inside the cysts could not be investigated because the specimens were damaged by the freezing conditions during transport. However, metacercariae from freshwater fish were reported as follows: *Acanthostomum* sp, *Centrocestus* sp, *Haplorchis* sp, *Haplorchoides* sp, and *Stellantchasmus* sp (Wongsawad *et al*, 2000). The metacercaria of *Heterophyes* sp were reported in brackish and fresh water. The *Tilapia* fish can obtain the metacercaria of Heterophyidae Digenea (Yamagut, 1975). *Heterophyes* and related members of the family *Heterophyidae* are minute intestinal flukes that are normally parasites of fish-eating birds and mammals. Moreover, fish surveys revealed that most trematode metacercariae were heterophyid flukes from several areas in northern Thailand and fish farms (Sukontason *et al*, 2001). The present investigation was undertaken to determine the intensity and distribution of trematode metacercariae in fish from southern Thailand.

Table 2
Number of metacercaria infections in mullet (*Valamugil cunnesius*), April 2001-April 2002.

Month / year	No. of examinations	No. of infections	No. of metacercariae					No. of metacercariae
			Dorsal fin and muscle	Pectoral fin and muscle	Ventral fin and muscle	Digestive tract	Gill	
Apr 2001	10	10	48	40	27	0	119	234
May 2001	25	23	75	45	31	6	168	325
Jun 2001	10	10	25	25	15	8	59	132
Jul 2001	10	9	15	11	4	2	23	55
Aug 2001	10	10	29	5	32	7	77	150
Sept 2001	2	2	13	11	15	1	0	40
Oct 2001	10	10	126	20	26	108	1	281
Nov 2001	15	15	114	32	23	58	0	227
Dec 2001	10	10	370	49	61	156	53	689
Jan 2002	6	6	27	2	6	27	91	153
Feb 2002	12	12	317	56	46	418	365	1,202
Ma 2002	1	1	1	1	2	1	2	7
Apr 2002	10	10	727	42	41	77	73	960
Total (%)	131 (100.0)	128 (97.7)	1,887 (42.4)	339 (7.6)	329 (7.4)	869 (19.5)	1,031 (23.1)	4,455 (100.0)

The intensity of metacercariae in the cyprinoid fish, which is an intermediate host of liver flukes, was studied for areas with the most and the least infection of fish by metacercariae (Sukontason *et al*, 2001). The study showed that the distribution of trematode metacercariae was abundant in the caudal fin, but rarely in the anal fin (Tesana *et al*, 1985; Sukontason *et al*, 2001). Namue *et al* (1998) reported that *Haplorchis* metacercariae were mainly localized on scales. In this study, metacercariae were examined from the fishes' dorsal fins, pectoral fins, ventral fins, digestive tracts, and gills. The number of metacercariae found at different parts of the fish samples were not significantly different ($p > 0.05$).

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