THE OCCURRENCE OF HETEROPHYID METACERCARIAE IN CYPRINOID FISH IN CHIANG MAI PROVINCE

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Abstract. The occurrence of the heterophyid metacercariae in cyprinoid fish from 10 districts of Chiang Mai Province, Thailand, was investigated from November 2001 to October 2002. Seven hundred sixty-seven out of 849 (90.34%) cyprinoid fish were infected with heterophyid metacercariae, namely: Stellantchasmus falcatus, Haplorchis taichui, Centrocestus caninus and Haplorchoides sp. The highest prevalence of heterophyid metacercariae (95%) was observed during the winter November - January (95%) and the lowest (90%) was observed during the summer months February - April (90%). S. falcatus metacercariae were found in Dermogenus pusillus only. The highest numbers of H. taichui, C. caninus and Haplorchoides sp metacercariae were collected from Henicorrhyncus siamensis, Rasbora perviei and Mystacoleucus marginatus, respectively. The distributions in the fish hosts also varied. The most common site for S. falcatus and H. taichui metacercarial infection was the muscle, whereas the greatest numbers of C. caninus and Haplorchoides sp metacercariae were found in the gills and scales, respectively. The high prevalence of heterophyid flukes observed in this survey suggests that people who live in this area are at high risk for heterophyid fluke infection.

INTRODUCTION

More than 21 species of heterophyid flukes have been reported in humans (Waikagul, 1991). Numerous species of Heterophyidae, such as Haplorchis taichui, H. pumilio, H. yokogawai, Stellantchasmus falcatus and Centrocestus caninus, have been documented to cause infection in humans residing in northeastern and northern Thailand (Manning et al., 1971; Kliks and Tantachamrun, 1974; Tantachamrun and Kliks, 1978; Radomyos et al., 1990, 1998; Tesana et al., 1991; Waikagul, 1991, 1998). The major cause of fish-borne trematodiasis in northern Thailand is the consumption of local Thai fish dishes, such as Lab-pla (Radomyos et al., 1998; Sukontason et al., 1999). Heterophyid metacercariae have been reported in freshwater fish collected from Mae Sa stream and in some areas of Chiang Mai Province (Wongsawad et al., 2000; Srialwit et al., 2003) and in northeastern Thailand (Srisawangwong et al., 1997). A survey of metacercarial infections in their second intermediate hosts, freshwater or brackish fish, showed that the dominant species are the members of Heterophyidae family, particularly H. taichui (Waikagul, 1998). It is predictable that heterophyid flukes will become the most dominant species of intestinal flukes in Thailand in the near future. It is necessary to know where it is endemic, therefore a year long survey of metacercarial infection in fish from 10 districts of Chiang Mai Province, Thailand, was performed.

MATERIALS AND METHODS

A survey of the seasonal prevalence of heterophyid metacercariae in fish caught from 10 districts of Chiang Mai, Thailand (Mae Rim, Mae Taeng, San Sai, Doi Saket, San Kamphaeng, Saraphi, Mueang, Hang Dong, San Pa Tong and Chom Thong), was
conducted from November 2001 to October 2002. Various species of freshwater fish were captured from and/or bought from the fishermen living near natural reservoirs in these districts and then examined in the laboratory. Taxonomic identification of the fish was based on the guidelines and atlas of freshwater fish in Thailand by Smith (1945), Department of Fisheries, Ministry of Agriculture and co-operative, and Wittayanon (2003). To determine the distribution of the metacercariae within the fish body, various organs of the fish were examined for heterophyid metacercariae, including the gills, scales, fins, muscles and body cavity, using digestion techniques as previously described by Srisawangwong et al (1997). The heterophyid metacercarial species were identified following the morphological descriptions given by Yamaguti (1958), Pearson and Ow-Yang (1982), and Wongsawad et al (2000).

RESULTS

A total of 849 freshwater fish, consisting of 18 fish species belonging to the family Cyprinidae, were collected during a year-round survey from November 2001 to October 2002.

Table 1

Numbers of heterophyid metacercariae collected from 18 fish species in 10 districts of Chiang Mai Province, Thailand from November 2001 to October 2002.

<table>
<thead>
<tr>
<th>Fish species</th>
<th>Numbers of fish infected /examined</th>
<th>Numbers of heterophyid metacercariae isolated</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sf</td>
<td>Ht</td>
<td>Cc</td>
</tr>
<tr>
<td><em>Dermogynus pusillus</em></td>
<td>426/442</td>
<td>191,218</td>
<td>0</td>
</tr>
<tr>
<td><em>Labiobarbus siamensis</em></td>
<td>54/60</td>
<td>0</td>
<td>3,609</td>
</tr>
<tr>
<td><em>Systomus orphoides</em></td>
<td>45/54</td>
<td>0</td>
<td>1,520</td>
</tr>
<tr>
<td><em>Tricopsis vittatus</em></td>
<td>23/38</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Barbonymus gonionotus</em></td>
<td>30/33</td>
<td>0</td>
<td>2,438</td>
</tr>
<tr>
<td><em>Henicorhynchus siamensis</em></td>
<td>55/62</td>
<td>0</td>
<td>10,542</td>
</tr>
<tr>
<td><em>Mystacoleucus marginatus</em></td>
<td>36/42</td>
<td>0</td>
<td>1,329</td>
</tr>
<tr>
<td><em>Tricogaster microlepis</em></td>
<td>13/15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Hampala macrolepidota</em></td>
<td>14/17</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>696/763</strong></td>
<td><strong>191,218</strong></td>
<td><strong>19,473</strong></td>
</tr>
</tbody>
</table>

Sf = *Stellantchasmus falcatus*  
Ht = *Haplorchis taichui*  
Cc = *Centrocestus caninus*  
Hsp = *Haplorchoides* sp
The overall infection rates and mean numbers of heterophyid metacercariae recovered from each fish species are shown in Table 1. The overall infection rates varied from 33.3% to 100% (Fig 1). Throughout the course of our survey, 255,926 heterophyid metacercariae were recovered from 18 fish species. Four species of heterophyid metacercariae, namely: Stellantchasmus falcatus, Centrocestus caninus, Haplorchis taichui and Haplorchoides sp. The highest mean density of S. falcatus metacercariae per fish (432.6; range 0 to 2,738) was observed in D. pusillus. D. pusillus was the only cyprinoid fish from which S. falcatus metacercariae were obtained. The highest mean intensities of H. taichui, C. caninus and Haplorchoides sp, were observed in Henicorhyncus siamensis (175.7; 0-769), Rasbora parvieu (14.1; 0-113) and Mystacoleucus marginatus (222.2; 0-572), respectively. In some fish species such as Labiobarbus siamensis, Systomus orphoides, Barbomyxus gonionotus, Henicorhynchus siamensis, Mystacoleucus marginatus, Puntioplites proctozysron and Hampala macrolepidota. There were mixed infections of heterophyid flukes, for example: H. taichui and Haplorchoides sp were found as mixed infections in the fins and scales of infected fish (Table 1). During the survey, S. falcatus metacercariae had the greatest prevalence followed by Haplorchoides sp and H. taichui, respectively. C. caninus had the lowest infection rate of all seasons (Fig 2).

Heterophyid metacercariae were found in various parts of the fish body (Fig 3). S. falcatus metacercariae were found in the muscles, head and visera, with the highest numbers recovered from the muscles. H. taichui metacercariae were found in the muscles, head, fins and scales; the greatest number were found in the muscles. C. caninus metacercariae were recovered from the muscles, fins and gills with the greatest number of metacercariae obtained from the scales.

DISCUSSION

The seasonal dynamics of the prevalence of heterophyid metacercariae in fish were observed for H. taichui and C. caninus infections. The highest prevalence of H. taichui was observed in the summer (February-April) and the lowest was observed during the rainy season (May-October). The highest prevalence of C. caninus infection was observed during the rainy season. These patterns are in contrast to those reported...
by Sukontason et al (1999) where the highest Haplorchis sp metacercariae prevalence was observed in the winter (November-January). Some researchers have reported an increase in the emergence of cercariae from the first intermediate host when the water temperature increases (Taskinen et al., 1994; Layholt and Buchman, 1996). However, in the present survey no seasonal changes were observed for the prevalence of S. falcatus. These results correspond to the prevalence of C. armatus metacercariae in some cyprinoid fish caught in the Chikusa River, in which there were no associated seasonal changes (Kimura and Uga, 2005). The changes in the prevalence of metacercariae with seasons may not be very conspicuous because metacercariae flourish for long periods of time inside the fish host and therefore no drastic changes in metacercarial prevalence may be observed at different seasons of the year (Chubb, 1979). C. caninus infection was the most prevalent during the rainy season. Cercarial infection may already have occurred during the summer before entering the rainy season.

The present study found that heterophyid metacercariae may be found in different parts of the fish body, such as the gills, fins, scales, muscles and visceral organs. S. falcatus and H. taichui metacercariae were principally found in the muscles of their fish hosts. Sripalwit et al (2003) found a 100% prevalence of S. falcatus

Fig. 2-The seasonal prevalences of 4 heterophyid metacercariae in fish collected from 10 districts in Chiang Mai Province during a year-round survey from November 2001 to October 2002.

Fig. 3-The distributions of 4 heterophyid metacercariae isolated from various parts of cyprinoid fish caught from 10 districts of Chiang Mai Province, Thailand.
metacercariae in *D. pusillus*, with the highest density in the muscles. *H. taichui* metacercariae were commonly found in cyprinoid fish, where the greatest abundance of metacercariae were in the muscles (Kumchoo *et al*., 2005). The above two studies reported no seasonal changes in the prevalence of metacercarial infections. This is in contrast with the findings of Sukontason *et al* (2001), who reported that *H. taichui* metacercariae were found more commonly in the caudal fin. The metacercariae are mostly found in the muscles of the base of the caudal fin. *Haplorchis* sp was found in mixed infections and was recovered from many kinds of cyprinoid fish, mostly in the scales, however the adults are known to parasitize the intestines of catfish (Waikagul and Radomyos, 2005). *C. caninus* metacercariae were only recovered from the gills in the present study, in contrast to Rim *et al* (1996) who found *C. armatus* metacercariae in different organs of the fish *Zacco temminckii* and *Z. platypus*. The metacercariae were distributed in the gills, muscles, intestines, scales and fins, where the greatest abundance of metacercariae was observed in the intestines. The observations of Kimura and Uga (2005) are similar to those of Rim *et al* (1996) except for the presence of *C. armatus* metacercariae in the brain. Heterophyid flukes have a low specificity for cyprinoid fish since their metacercariae are commonly isolated from various fish species. The distribution of heterophyid flukes may depend on the biochemical properties of the fish hosts and parasite species themselves. This present study found heterophyid flukes in fish from 10 districts of Chiang Mai Province. People who live in these endemic areas are at high risk for heterophyid fluke infections based on the high infection rates of the heterophyid trematodes in cyprinoid fish. Heterophyid infections found in fish which serve as the protein-food sources or are economically important, such as exported ornamental fish, can result in a reduction in fishery yields and economic losses.

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### REFERENCES


