



FIRST REPORT ON ASIAN FISH TAPEWORM (*BOTHRIOCEPHALUS ACHEILOGNATHI*) INFECTION OF INDIGENOUS MAHSEER (*TOR TAMBRA*) FROM NAGAN RAYA DISTRICT, ACEH PROVINCE, INDONESIA

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**Summary**

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The aim of the present study was to examine the prevalence and intensity of the Asian fish tapeworm, *Bothriocephalus acheilognathi* on the indigenous mahseer fish *Tor tambra*. The fish samples were collected from Isiep River, Nagan Raya District as representative of wild population and from aquaculture ponds as representative of captive population. A total of 30 fish samples from Krueng Isep river and 30 fish samples from aquaculture fish ponds were examined in this study. The fish samples were abdominally dissected and the alimentary tracts were taken and perforated. The alimentary contents were placed onto Petri dish and observed for tapeworms. The samples of worm were photographed using stereo microscope. The results showed that the fish samples from aquaculture fishponds were infected by *Bothriocephalus acheilognathi* with the prevalence and intensity of 53.33% and 8.06, respectively, while no fish from the river was infected by cestoda.

**Key words:** *Bothriocephalus acheilognathi*, cestodes, intensity, keureling, prevalence

INTRODUCTION

Keureling fish or internationally named mahseer (*Tor tambra*) is one of the popular freshwater fish in Indonesia. The fish has a good taste and higher price in local and regional markets (Muchlisin *et al.* 2015). At present, the spawning of this

species has been successfully induced and it is experimentally cultured in the pond. However, the keureling fish in captive conditions is very susceptible to parasites infestation. Muchlisin *et al.* (2014) reported that about 50% of keureling popula-

tions in aquaculture ponds were infected by *Lernea* sp., *Argulus* sp. and *Trichodina* sp. In addition, the preliminary field observation revealed that the cultured mahseer was also infected by cestodes of the Asian fish tapeworm, *Bothriocephalus acheilognathi*. Hence, this is the first report on the Asian fish tapeworm infection from western part of Indonesia.

The *Bothriocephalus acheilognathi* was first described in Japan from intestine of *Acheilognathus rhombea* (Yamaguti, 1934) and currently is the common endoparasite for freshwater fish worldwide, particularly cyprinids (Marcogliese, 2008; Choudhury & Cole, 2011). This worm has been reported to infest fish in the USA (Heckmann *et al.*, 1993; Scholz, 1997; Kuperman *et al.*, 2001), Europe (Marcogliese, 2008) and other parts of the world, koan fish in Iran (Hosseinfard *et al.*, 2011), some native freshwater fish species in Mexico (Salgado-Maldonado & Pineda-Lopez, 2003). According to Choudhury *et al.* (2013) the grass carp, *Ctenopharyngodon idella* could be considered a principal host for *B. acheilognathi* in Panama and worldwide. Nowadays this parasite has been categorised as global freshwater invasive species due to the success of invasiveness; however, no report from Indonesia was available. According to Ozturk & Ozer (2014) the wide spread of Asian tapeworm has occurred in two ways; import-export of exotic cyprinids for culture and introduction of grass carp for controlling macrophytes in different region throughout the world (Boomker *et al.*, 1980).

In general, besides infecting fish, the cestodes are also likely to infect humans consuming the infected and improperly cooked fish (Justine *et al.*, 2012; Yera *et al.*, 2013). Some species of cestodes infect men for long period without any symp-

toms (Waeschenbach *et al.*, 2012). The objective of the present study was to evaluate the prevalence and intensity of *B. acheilognathi* infection on local mahseer fish from wild and captive population in Nagan Raya District, Indonesia. This is the first report for infection of *Bothriocephalus acheilognathi* in freshwater fish from Aceh region, Indonesia.

## MATERIALS AND METHODS

### *Study site and time*

The study was conducted in Beutong Sub-district, Nagan Raya, Aceh Province, Indonesia from December 2013 to February 2014. The wild population sample was collected from Isiep River (04°16'51.61"N, 96°26'58.53"E), while captive fish were collected from aquaculture ponds (4°14'50.53"N, 96°26'13.48"E) in Meunasah Krueng village of Nagan Raya. The laboratory analyses were carry out in Syiah Kuala University and Brackishwater Aquaculture Station, Ujung Batee in Banda Aceh and Aceh Besar, respectively.

### *Sampling*

Samplings were conducted during the rainy season, December 2013. A total of 60 fish were collected randomly from wild (30 individuals) and captive (30 individuals) populations using casting nets with two mesh sizes (1.0 and 2.0 inches). Collected fish were preserved in ice box (4 °C) until transported to laboratory for further analysis. The main water quality parameters such as dissolved oxygen, pH, temperature and turbidity were measured *ex situ*.

### *Sample preparation and analysis*

The fish samples were anaesthetised in a solution of tricaine methanesulfonate (MS 222), prepared by dissolving 4 g of MS

**Table 1.** Prevalence and intensity of Asian fish tapeworm *Bothriocephalus acheilognathi* in the alimentary tract of keureling fish (*T. tambra*) collected from wild and captive systems

Parameters	Populations	
	Captive (n=30)	Wild (n=30)
Total number of infected fish	16	–
Total number of tapeworms	129	–
Intensity	8.06	–
Prevalence (%)	53.33	–

222 in 5 L tap water (Muchlisin *et al.*, 2004) measured for total length (cm) and body weight (g), and then submitted to abdominal dissection using sterile scissors. The alimentary tract were removed, placed into a jar then perforated with a needle and the alimentary contents were placed onto Petri dish and observed for Asian tapeworm cestodes naked-eye or using a magnifying glass. The samples of worm were taken from the Petri dish, placed onto object glass and two drops of safranin were added to the sample for observation under stereo microscope (40–100× magnification) and photographed. Identification of cestodes was based on Khalil *et al.* (1994).

The prevalence and intensity of infection were calculated based on Kabata (1985) as followed: Prevalence=(total of infected fish/total of examined fish) × 100%; Intensity=total of parasites/total of infected fish.

## RESULTS

The fish samples from captive system (ponds) were infected by *Bothriocephalus acheilognathi*, while no fish from the wild population was infected by this worm. A total of 16 fish samples from the captive system were infested by *B. acheilognathi* resulting in 53.33% prevalence and 8.06

of intensity. A total of 129 tapeworms were recorded during the study (Table 1).



**Fig. 1.** Morphology of Asian fish tapeworm (*Bothriocephalus acheilognathi*) showing scolex and proglottids (arrows).

As recorded in this study and according to Scholz (1997), *B. acheilognathi* had specific characteristics: pyramid-shape scolex with a pair of bothria, segmented body (proglottids), no neck and no dorsal or ventral median furrow (Fig. 1).

## DISCUSSION

This study revealed that the prevalence of Asian tapeworm in *Tor tambra* was relatively higher compared to that in fish from Bafra Fish Lake, the lower Kizilirmak Delta, Turkey (Ozturk & Ozer, 2014) and *Labeobarbus aeneus* (Bertasso & Avenant-

Oldewage, 2005). However, the highest prevalence of Asian tapeworm was reported in *Labeobarbus kimberleyensis* (Bertasso & Avenant-Oldewage, 2005), *Cyprinella lutrensis* (Heckmann *et al.*, 1995) and *Profundulus hildebrandi* from the endorheic basin of San Cristobal de las Casas, Mexico (Velazquez-Velazquez *et al.*, 2011).

We suggest that this was due to the poor sanitary condition of the pond. Our field observation indicates that the sludge from the deposition process of residual water and unconsumed feed and fish faeces at the pond bottom had reached a thickness of 20–25 cm. Based on Khalil *et al.* (1994), bottom sludge is the appropriate medium for growing of cestode larvae in the pond. Therefore, the prevalence of the endoparasite *B. acheilognathi* in local mahseer fish (*T. tambra*) was higher compared to that of ectoparasites as reported previously by Muchlisin *et al.* (2014). In addition, the prevalence of *B. acheilognathi* has probably a seasonal pattern with higher prevalence during the summer and lower in winter as recorded for *Schizothorax niger* (Zargar *et al.*, 2012). Our study was conducted during the rainy season (winter), so, a higher prevalence would be expected during the dry season in Indonesia. Therefore, further study is needed to evaluate the real prevalence and intensity of this Asian tapeworm during the different seasons in the region.

The Asian tapeworm was probably introduced accidentally into the Nagan Raya region with infected common carp (*Cyprinus carpio*) from Java Island, Indonesia in 2006 by Local Fisheries Affair (DKP). The common carp was also suspected as origin of *B. acheilognathi* infection in the endangered fish *Profundulus hildebrandi* in Mexico (Velazquez-Velazquez *et al.*, 2011).

The study revealed that only fish sampled from aquaculture pond (captive system) were infected by tapeworm and no fish from wild river population had the tapeworm. According to Williams & Williams (1996), the Asian tapeworm requires a copepod intermediate host and we speculate that aquaculture ponds provide ideal conditions for copepods and tapeworm transmission as mentioned earlier. According to Choudhury *et al.* (2013) streams are relatively less suitable for copepods growing and therefore *B. acheilognathi* was not found in the fish sample from stream as recorded in this study.

The Asian tapeworm had infected cyprinids in many countries of almost all continents and this is the first report from Aceh region, Indonesia. *B. acheilognathi* infection impairs fish health, body condition and growth (Marcogliese, 2008) and causes great economic losses in hatcheries and fish farms worldwide (Kuperman *et al.*, 2001; Zargar *et al.*, 2012). Therefore, the Asian tapeworm is a potential threat for aquaculture industry and a special attention to eradicate the invasiveness is needed.

## CONCLUSION

The mahseer fish (*T. tambra*) sampled from aquaculture pond in Nagan Raya district, Indonesia was infected by the Asian fish tapeworm *Bothriocephalus acheilognathi* at a prevalence of 53.33% and intensity of 8.06, while no fish sample from the Isiep River wild population was infected by this worm.

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