Aquaculture 295 (2009) 1–5

Contents lists available at ScienceDirect

Aquaculture

journal homepage: www.elsevier.com/locate/aqua-online

Prevalence of zoonotic trematode parasites in fish fry and juveniles in fish farms of the Mekong Delta, Vietnam

Cu Pham Thien [a,b], Anders Dalsgaard [a], Nguyen Thanh Nhan [b], Annette Olsen [c], K. Darwin Murrell [a,*]

[a] Department of Veterinary Disease Biology, Faculty of Life Sciences, University of Copenhagen, Groennegaardsvej 15, DK-1870 Frederiksberg, Denmark
[b] Research Institute for Aquaculture No 2, 116 Nguyen Dinh Chieu Street, District 1, Ho Chi Minh city, Vietnam
[c] Section for Parasitology, Health and Development, Department of Veterinary Disease Biology, Faculty of Life Sciences, University of Copenhagen, Denmark

ARTICLE INFO

Article history:
Received 5 February 2009
Received in revised form 18 June 2009
Accepted 23 June 2009

Keywords:
Aquaculture
Zoonotic parasites
Trematodiasis
Nursery
Infection risk
Vietnam

ABSTRACT

Zoonotic parasites are a significant food safety problem, particularly in Asia. In Vietnam fishborne zoonotic trematodes (FZT) are highly prevalent in fish cultured in grow-out farms. However, FZT infection status of juveniles produced and distributed by hatcheries and nurseries is unknown. Here we report an epidemiological investigation on FZT in fry and juveniles of major cultured freshwater fish species in four provinces of the Mekong Delta of Vietnam. No FZT infections were found in 14 species of fry sampled from hatcheries. In contrast, nursery juveniles of river catfish, hybrid catfish, giant gouramy, climbing perch, common carp, kissing gouramy, silver barb, silver carp, grass carp, Indian carp, pacu, tilapia and snakeskin gouramy were frequently infected with FZT metacercariae (range 1.2–29.7%). Seasonal variation in prevalence was observed: prevalence in river catfish and hybrid catfish were maximal in January, at the end of the flooding season, while the prevalence in juveniles of giant gouramy, climbing perch, common carp, kissing gouramy, silver barb, silver carp grass carp, mrigal and pacu were higher in the wet season, June to November. Overall, FZT prevalence was highest in climbing perch and giant gouramy (29.7% and 27.8%, respectively) and the lowest in river catfish (1.2%). The density of FZT metacercariae in fish varied seasonally only in climbing perch which was maximal in the wet season ($P<0.05$), compared to the dry season (430 vs 28 metacercariae/100 g of fish). These results demonstrate that acquisition of infected seed stock from nurseries is a serious risk for Vietnamese grow-out fish farms, and stress that interventions to control FZT must focus also on these stages of the cultured fish production cycle.

1. Introduction

Fish are a very important source of protein for people living in rural areas of Southeast Asia, where cultural habits of eating raw or inadequately prepared dishes often lead to infection with fishborne zoonotic trematodes (FZT) (Chai et al., 2005). These zoonotic species of trematodes ("flukes") can be transmitted as larvae (metacercariae) to a wide range of mammals and fish-eating bird hosts through the eating of raw or improperly cooked fish. In these hosts, the trematodes become sexually mature, produce eggs which are voided in the feces, and if these reach bodies of water containing suitable snail hosts, infect them and reproduce asexually. Eventually the snail sheds numerous swimming trematode larvae, called cercariae, which can infect many species of fish, in which they encyst and develop to the metacercarial stage, completing the life cycle. Although Vietnam has a high risk of FZT in humans (De et al., 2003; Dung et al., 2007), the information on the epidemiology of these infections in the country's fish is limited. The World Health Organization (1995, 2004) has estimated that the number of people currently infected in south-east Asia with FZT exceeds 18 millions. This includes the liver flukes (*Opisthorchis viverini*, and *Clonorchis sinensis*) which are a major public health problem (Sripa et al., 2003), and the twenty-three species of intestinal flukes which have been reported from man, especially in south-east Asia (Chai, 2007). Recently, infections with zoonotic trematodes in Vietnamese cultured and wild-caught fish from the Mekong Delta have been discovered (Thu et al., 2007; Thien et al., 2007), raising food safety concerns.

In Vietnam, as elsewhere, fry from hatcheries are distributed to nurseries which grow the fish to the juvenile stage. Fry in hatcheries are grown in a protected and highly controlled environment while the nurseries are typically earthen ponds with high exposure to various external environmental factors, i.e. faecal contamination from various animals and human activities. The juveniles are marketed widely to farms which in grow-out ponds produce the end product, market fish for consumers. The fry can be produced year round although the main

* Corresponding author. 5126 Russett Road, Rockville, Maryland, 20853, USA. Tel./fax: +1 301 460 9307.
E-mail address: kdmurrell@comcast.net (K.D. Murrell).

0044-8486/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.aquaculture.2009.06.033

spawning season is from April to September in the Mekong Delta region. Juveniles are produced throughout the year.

An important need for the development of effective control interventions and preventive management practices for aquaculture is greater knowledge of the epidemiology of FZT in the fish production chain. To contribute to this goal, a series of investigations are being carried out in the important Mekong Delta production areas to assess the status of FZT in cultured fish and to identify important risk factors. The initial investigations on grow-out fish have been reported by Thien et al., (2007). Chi et al. (2008) also reported a high prevalence of FZT in juveniles in cultured fish in the northern province of Nghe An. This study was conducted to examine further this problem in the production of fry and juveniles in the Mekong Delta. The results of this investigation are reported here.

2. Materials and methods

2.1. Survey areas and study design

The study was carried out in Tien Giang, Can Tho, Vinh Long and Dong Thap provinces in the Mekong Delta of Vietnam where fish fry and juvenile production in aquaculture are highly developed (Fig. 1). Typically fish fry are produced in hatcheries and then transferred to nurseries when approximately 2 days of age (river catfish), 1 week (giant gouramy) or 3 days old for the other fish species included in this study. The juveniles are grown to market size over a period of 4–12 weeks, depending on the stocking density and the fish species, and are then widely distributed geographically to grow-out farms where they are fed to commercial market size. The hatcheries and nurseries studied were selected randomly from a list provided by the Departments of Agriculture and Rural Development in each of the four provinces.

A cross-sectional study for FZT infection in fry was performed with a single sampling of fry of 14 fish species (total of 302 samples, Table 1) from the Tien Giang, Can Tho, Vinh Long, and Dong Thap provinces during the period of May to October 2007, the season for spawning of the major freshwater fish in southern Vietnam.

Table 1
Species of fish fry and juveniles collected from hatcheries and nursery ponds located in Tien Giang, Vinh Long, Can Tho and Dong Thap provinces in the Mekong Delta, Vietnam (2007–2008).

Fish species	Number of hatcheries[a]	Number of nurseries[a]
Climbing perch/*Anabas testudineus*	22	32
Common carp/*Cyprinus carpio*	18	41
Giant gouramy/*Osphronemus gourami*	14	18
Grass carp[b]/*Ctenopharyngodon idellus*	18	41
Hybrid catfish/*Clarias* sp.	17	33
Kissing gouramy/*Helostoma temmincki*	21	32
Mrigal/*Cirrhinus mrigala*	18	41
Pacu[b]/*Colossoma macroponmum*	21	32
Red tilapia/*Oreochromis* sp.	31	42
River catfish/*Pangasianodon hypophthalmus*	34	82
Silver barb/*Puntius gonionotus*	19	32
Silver carp/*Hypophthalmichthys molitrix*	18	41
Snakeskin gouramy/*Trichogaster pectoralis*	21	32
Tilapia/*Oreochromis niloticus*	30	40

[a] An individual hatchery or nursery often produced more than 1 fish species.
[b] Fry of grass carp and pacu were produced outside the 4 provinces, but was transported to nurseries in 1 or more of the 4 study provinces.

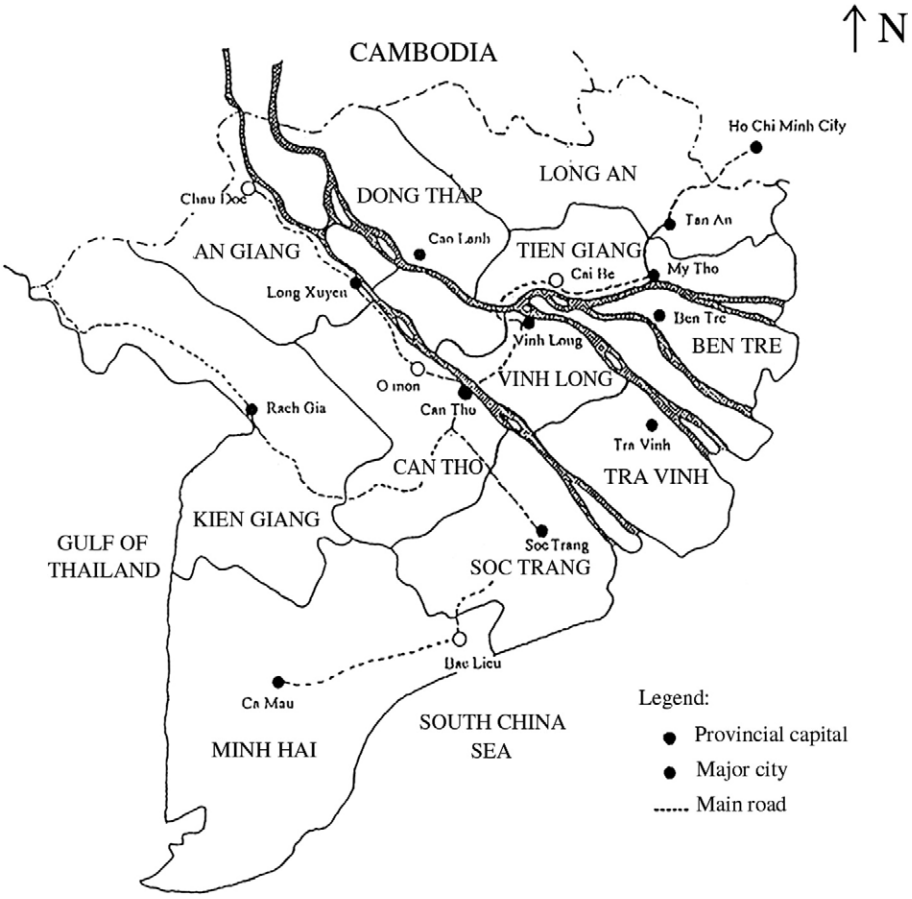

Fig. 1. The map shows the location of the four study provinces of Tien Giang, Can Tho, Vinh Long and Dong Thap in the Mekong Delta.