CHAPTER I
INTRODUCTION

1.1 Backgrounds and rationales

Fish-borne zoonotic trematodes (FZT) including liver and intestinal flukes, are significant public health problems worldwide, especially in Asian countries (WHO, 1995, 2004; Chai et al., 2005a; Keiser and Utzinger, 2005). In the past, these diseases were limited for the most part to populations living in low and middle-income countries, but the geographical limits and populations at risk are expanding and changing because of growing international markets, improved transportation systems, and demographic changes (such as population movements). The number of people currently infected with FZT was recently estimated by the World Health Organization (WHO) to exceed 18 million; however, the number of people at risk worldwide is more than 500 million (WHO, 2004). Recent figures suggest that about 1.5 million people in Korea, 6 million people in China, and over 9 million in Thailand are infected with liver flukes (*Clonorchis sinensis* or *Opisthorchis viverrini*) (Chai et al., 2005a; Yoshida, 2005). However, many of the numerous species of intestinal heterophyids and echinostomatids are also important, but less well recognized, compared to liver flukes (Chai et al., 2005a; Waikagul and Radomyos., 2005; Yu and Xu., 2005).

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 FZT (Chai et al., 2005a). These zoonotic species of trematodes can be transmitted as 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 encysted and develop to the metacercarial stage to complete the life cycle.

Over the last ten years, there has been a steady growth in inland aquaculture production in the Lower Mekong Basin areas of Asian countries (Vietnam, Thailand, Cambodia and Lao PDR) from an estimated 60,000 tons in 1990 (Interim Committee for the Coordination of Investigations of the Lower Mekong Basin, 1992) to around 260,000 tons (1999/2000 figures). The farm gate value of aquaculture products in 1999/2000 was around US$ 263 million. Production from aquaculture represented around 12-13 percent of the estimated 2,036,000 tons of aquatic products produced in the Lower Mekong Basin.

Studies conducted in Vietnam revealed that in the Mekong Delta, 1.2–29.7% of cultured fish were infected with FZT metacercariae (Thu et al., 2007; Thien, 2009) whereas in the North, prevalence of FZT was 44.6% in Nghe An province (Chi et al., 2008) and was >50% in Nam Dinh province (Van et al., 2010). A similar study in Thailand is not available but a preliminary survey in Khon Kaen revealed the presence of *O.viverrini* as well as other FZT in 3 species of fingerlings on sale at the Khon Kaen Fishery Station (Pitaksakulrat, unpublished). A recent study in Vientiane, Lao PDR, also showed that FZT are present in several species of culture fish (Sithithaworn, unpublished). Thus searching for effective ways to control the transmission of FZT in culture fish is needed. This approach should also contribute to the control of the liver fluke in the region.

Production of FZT-free fish in aquaculture is a key component in establishing a sustainable program to prevent and control the FZT transmission to humans. However, intervention of FZT in aquaculture system requires knowledge of risk factors associated with the transmission. Based on preliminary data, the present study was carried out to prevent transmission of FZT in 2 aquaculture farms in Vientiane, Lao PDR and monitor the impact on FZT infection in fish for a period of 6 months. This would allow assessment and analysis of risk factors and their importance for FZT infection in fish at farm level

1.2 Research questions

To assess impacts of farm management plan for prevention of FZT transmission in aquaculture system. The basic research question is to understand the nature and sources of FZT in fish ponds and analyzing relevant risk factors under filed conditions in order to develop an effective and practical FZT prevention program. Specific issues in questions are:

1. Whether pond preparation by snail eradication by liming, prevention of animal from entering the pond by protective fencing, creating dice surrounding the fish pond and using filtered water affect FZT transmission in fish ponds?

2. Are there differences in susceptibility of different species of culture fish to FZT infection in the studied farms?

3. Whether human and animal hosts serve as sources of FZT contamination for fish ponds in fish farms?

4. Whether the presence of FZT infection in snails contributes directly to FZT transmission in fish farms?

1.3 Objectives of this study

The overall objective is to perform a field trial for FZT control in fish farms such that sources of FZT within the aquaculture system can be prevented and their consequences on culture fish are assessed.

1. To evaluate farm improvement measures and the use of filtered water in fish ponds which contribute to prevention of FZT in aquaculture farms.

2. To compare the susceptibility of common species of culture fish to FZT infection in the studied farms.

3. To determine the source (s) (human, animals and snails) of FZT that contaminates fish ponds and lead to infection in fish.

4. To identify and compare the life stages of FZT in snails, fish, human and animal hosts in fish farms by morphological and molecular methods.

1.4 Limitations of this study

1.4.1 Sample collection

Since the studied areas are in Lao PDR, collection and transportation of samples for examination of FZT in the laboratory is expensive and required extensive effort. In the snail study, several types of cercariae are still not known and required an aid of PCR in identification. Some types of cercariae are too few and may not be adequate for PCR testing.

1.5 Anticipated outcome

Farm improvement by pond preparation and use of filtered water, as well as the susceptibility of fish to FZT and the source (s) (human, animals and snails) of FZT that contaminates fish ponds and culture fish should provide basic knowledge for understanding the epidemiology of FZT in fish farm. The resulting information is thought to be useful for design of effective prevention of FZT in fish ponds.