

FRESHWATER MOLLUSKS OF MEDICAL IMPORTANCE IN KALASIN PROVINCE, NORTHEAST THAILAND

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Abstract. A snail survey was performed in six districts around irrigation areas of Lampao Dam, in Kalasin Province. The survey caught a total of 5,479 live snails and classed them into five families, 12 genera and 15 species, of which 7 species are suspected of transmitting human parasitic diseases. The seven species were *Pila polita*, *Pomacea canaliculata*, *Filopaludina (S.) m. martensi*, *Bithynia (Digoniostoma) siamensis goniomphalos*, *Melanoides tuberculata*, *Radix rubiginosa*, and *Indoplanorbis exustus*. Of these, *B. (D.) s. goniomphalos* and *I. exustus* were found to harbor emergent cercariae. Only *B. (D.) s. goniomphalos* hosted several types of cercariae - *Opisthorchis viverrini*, unidentified species of intestinal flukes, echinostomes, xyphidio and furcocercous cercariae. *Indoplanorbis exustus* shed only echinostome cercariae. *B. (D.) s. goniomphalos* showed a rather high natural infection rate with *O. viverrini*, 1.3% in Yang Talat district, and 0.61% in Kamalasai district, in Kalasin Province.

INTRODUCTION

Freshwater mollusks are known to host a wide variety of parasites. Most digenetic trematode species, generally termed flukes, seem to require a molluscan host to complete their life cycles, and at least one, or as many as three, additional hosts (Dillon, 2000). Schistosomiasis is an important public health problem in the tropics worldwide. It is caused by several species of the blood fluke, *Schistosoma*. *Schistosoma mekongi* had been found in many South-east Asia countries, such as Cambodia, Lao PDR, Vietnam, and Thailand (Voge *et al*, 1978; Harinasuta, 1980; Sornmani *et al*, 1980). The pomatiopsids genera, *Neotricula* and *Tricula*, serve as snail intermediate hosts. The liver fluke, *Opisthorchis viverrini*, is a significant human parasite found on a large endemic scale in north and northeast Thailand. The snail hosts mediating the disease are members of the freshwater prosobranch family Bithyniidae: *Bithynia*

(*Digoniostoma*) *siamensis siamensis* in central, *Bithynia (Digoniostoma) siamensis goniomphalos* in northeast, and *Bithynia (Digoniostoma) funiculata* in northern Thailand. A parasitic disease of man, meningoencephalitic angiostrongyliasis is caused by the lung worm of the rat, *Angiostrongylus cantonensis*, which is known to be transmitted by many species of freshwater snails in the family Ampullariidae- *Pila ampullacea*, *P. polita*, *Pomacea* spp, and other land snails (Burch and Upatham, 1989).

Opisthorchiasis is still a public health problem in some areas of the country, although control campaigns have been present for a long time. The existence and re-emergence of the parasitic disease in the population may be sustained by many factors, such as the behaviors of people that risk contact with the disease, the culture of the local people, such as the way of thinking that eating raw fish is a symbol of being a strong man. In addition, water resource development programs that are implemented, construction of dams and irrigation systems, to provide more water for agricultural land, flood control, and hydro-electric power production may have some adverse effects following dam construction, such as spreading local endemic diseases or introducing new disease vectors into the area.

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Kalasin Province, in northeast Thailand, has reported both opisthorchiasis and meningoencephalitic angiostrongyliasis. Kalasin also has the longest earth-core dam, Lampao Dam, built for agricultural purposes and flood control in downstream areas, in 1985. No survey for freshwater snails of medical importance has been conducted since the construction of the dam. This study aimed to conduct a survey of freshwater snails of medical importance related to public health investigation around the dam site.

MATERIALS AND METHODS

The study sites were in six districts of Kalasin Province, in the Lam Pao Dam irrigation system (Fig 1). Six collection stations were selected based on areas of public health impact around the dam site. The survey was conducted during 9 - 24 December 2003, using a 15-minute search-sampling snail collection by five survey-

ors. At each station, the team collected all snails found by hand and/or standard wire-mesh scoops, and put each samples in separate, labeled plastic bags. Snails were examined for infection at a field station by the shedding method. The method was to put 5-10 snails in small plastic vials half-filled with dechlorinated water and exposed to a 60 W light for two hours, or overnight. If cercariae were found in any of the vials, the snails were isolated by placing them each in a separate vial to observe for shedding. The snails were subsequently induced to aestivate, at a normal temperature, and wrapped in newspaper for transportation to the laboratory at the Faculty of Tropical Medicine, Mahidol University, Bangkok.

In the laboratory, each snail sample was maintained in a plastic aquarium and fed with diatoms. Snails of medical importance were searched thoroughly for emerging cercariae for at least 4-5 times.

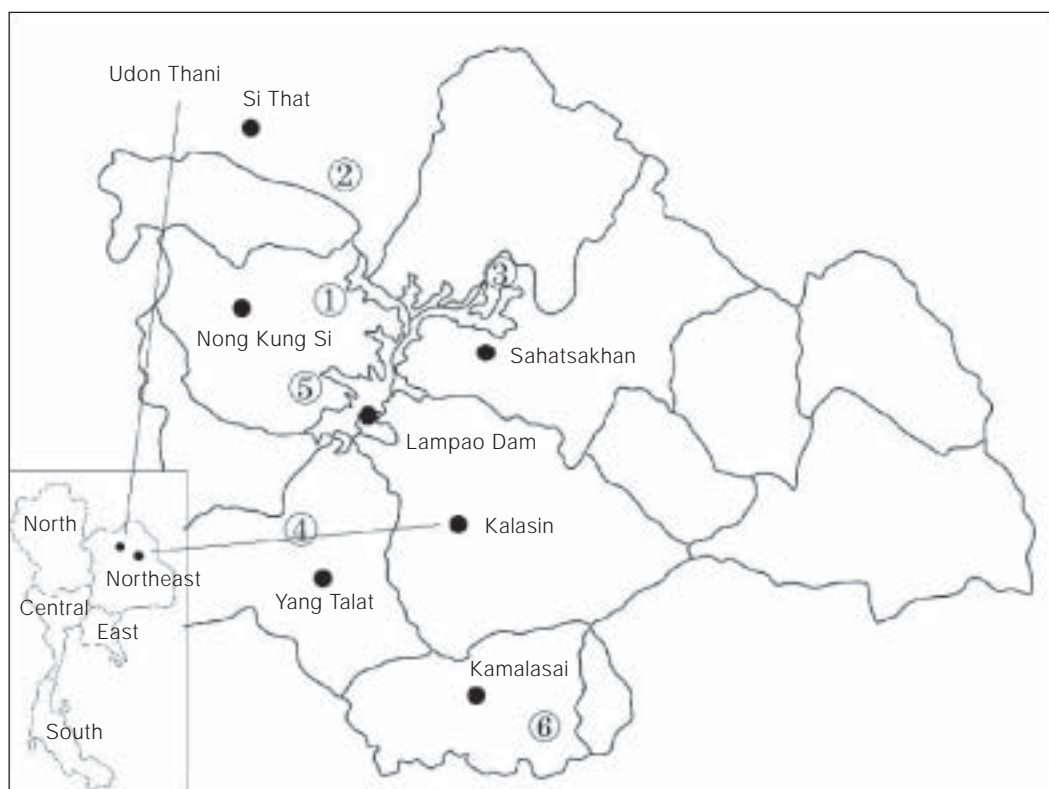


Fig 1—Map of Thailand showing Lam Pao Dam, Kalasin and Udon Thani Provinces, and the six collection sites.

Table 1
Total snails collected from Lam Pao Dam and its irrigation areas.

Family/Genus/Species	Localities ^b						Total
	1	2	3	4	5	6	
Family Ampullariidae							
<i>Pomacea canaliculata</i> ^a	6	25	19	8	4	4	66
<i>Pila polita</i> ^a	-	-	-	-	-	6	6
Family Viviparidae							
<i>Filopaludina (S.) martensi martensi</i> ^a	36	27	7	4	76	25	175
<i>Filopaludina (F.) sumatrensis speciosa</i>	7	5	13	-	1	-	26
<i>Filopaludina (F.) sumatrensis polygramma</i>	-	-	3	14	-	6	23
<i>Trochotaia trochoides</i>	-	5	4	-	1	-	10
<i>Idiopoma umbilicata</i>	-	12	-	-	-	-	12
<i>Idiopoma dissimilis</i>	-	5	-	-	-	-	5
Family Bithyniidae							
<i>Bithynia(D) siamensis goniomphalos</i> ^a	600	620	550	790	2,149	165	4,874
Family Thiariidae							
<i>Adamieta housei</i>	-	2	-	-	-	16	18
<i>Melanoides tuberculata</i> ^a	-	7	-	49	-	-	56
<i>Tarebia granifera</i>	-	-	-	-	-	33	33
Family Buccinidae							
<i>Clea helena</i>	11	5	-	32	68	11	127
Family Lymnaeidae							
<i>Radix auricularia rubiginosa</i> ^a	9	-	-	-	-	-	9
Family Planorbidae							
<i>Indoplanorbis exustus</i> ^a	20	5	2	-	12	-	39
Grand total	689	718	598	897	2,311	266	5,479

^aMedically - important mollusks

^bSite 1: Ban Nong Bua No.8, Nong Bua subdistrict, Nong Kung Si district, Kalasin

Site 2: Ban Koke Si No. 8, Si That subdistrict, Si That district, Udon Thani

Site 3: Ban Koke Gong No. 3, Non Sira subdistrict, Sahatsakhan district, Kalasin

Site 4: Ban Koke Gong, Bua Ban subdistrict, Yang Talat district, Kalasin

Site 5: Ban Khum Noi, Sao Lao subdistrict, Nong Kung Si district, Kalasin

Site 6: Ban Bo, Tan Ya subdistrict, Kamalasai district, Kalasin

RESULTS

The survey collected a total of 5,479 snails, which were classified into five families, 12 genera, and 15 species using Brandt (1974) keys (Table 1). Seven species were suspected of transmitting human diseases (Table 2). They were all examined for emergence of cercariae. Several types of *Bithynia (Digoniostoma) siamensis goniomphalos* cercariae were found, *Opisthorchis viverrini* (Wykoff *et al*, 1965), an unidentified species of intestinal fluke, echinostome, xyphidio and furcocercous cercariae. All infected

snails had only a single infection (Table 3). *Indoplanorbis exustus* shed only echinostome cercariae (Table 4). The percentage of infection of *O. viverrini* cercariae in *B. (D.) s. goniomphalos* was 1.3% in Yang Talat district, and 0.61% in Kamalasai district.

DISCUSSION

Of all medically important mollusks, bithyniid snails play an important role in transmitting *Opisthorchis viverrini* in Thailand (Wykoff *et al*, 1965; Burch and Upatham, 1989). *Opisthorchis*

viverrini needs two intermediate hosts to complete its life cycle. Its egg contains a fully formed miracidium and moves from the bile duct into the intestine, and finally passes into the feces. Daily egg intensity is about 1,000-30,000 eggs/gram of feces. The egg is ingested by a bithyniid snail and the miracidia hatches in the intestine

of the snail and develops into a sporocyst and redia in the hepatopancrease. The redia then grows to form cercariae. The cercaria emerges from the snail into the water and penetrates beneath the scales of freshwater fish to form a metacercarial cyst in the subcutaneous connective tissues, usually near the pectoral and caudal fins.

Brockelman *et al* (1986) reported that natural infection of *O. viverrini* in *B. (D.) s. goniomphalos* was remarkably low, even in an endemic area of Khon Kaen Province. The prevalence rates, reported by using mean *O. viverrini* in *B. (D.) s. goniomphalos* in Khon Kaen, during the period November 1980 - March 1984, were between 0.11-0.63%. Lohachit (2001) also studied the monthly infection rates of *O. viverrini* in *B. (D.) s. goniomphalos* in Khon Kaen, and reported rates of infection between 0.03-0.36%. In this study, we found the prevalence of *B. (D.) s. goniomphalos* in Yang Talat district was 1.3%, and in Kamalasai district it was 0.61%, which seem rather high for a natural infection rate of *O. viverrini*. Moreover, *O. viverrini* metacercariae were also found in cyprinoid fish caught in the

Table 2
Medically important mollusks potentially transmitting disease.

Species	Potential disease
1. <i>Pomacea canaliculata</i>	Angiostrongyliasis
2. <i>Pila polita</i>	Angiostrongyliasis
3. <i>Bithynia(D) siamensis goniomphalos</i>	Opisthorchiasis Echinostomiasis
4. <i>Filopaludina(S.) martensi martensi</i>	Echinostomiasis
5. <i>Melanooides tuberculata</i>	Paragonimiasis Echinostomiasis
6. <i>Radix rubiginosa</i>	Echinostomiasis Cercarial dermatitis
7. <i>Indoplanorbis exustus</i>	Echinostomiasis Cercarial dermatitis

Table 3
Types of cercariae from field-infected *Bithynia (D.) s. goniomphalos* in six collection stations.

Type of cercariae	Stations / No. of infected snails examined					
	1	2	3	4	5	6
<i>Opisthorchis viverrini</i>	-	-	-	10 (1.3) ^a	-	1 (0.61)
Intestinal flukes	-	1 (2.1)	-	-	-	-
Echinostomes	20 (3.3)	1 (0.1)	9 (1.6)	19 (2.4)	1 (0.05)	-
Xyphidia	5 (0.8)	-	23 (4.2)	46 (5.8)	4 (0.2)	2 (1.2)
Furcocerous	-	-	-	2 (0.3)	-	-

^aPercentage infection rate of snails

Table 4
Type of cercariae from field-infected *Indoplanorbis exustus* in six collection stations.

Type of cercariae	Stations / No. of infected snails examined					
	1	2	3	4	5	6
Echinostome	1 (5.0) ^a	-	-	-	-	-

^apercentage infection rate of snails

same areas. It is likely that *O. viverrini* in Kalasin Province is still rather high in prevalence.

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