

RESEARCH NOTE

THE FIRST REPORTED CASES OF CANINE SCHISTOSOMIASIS MEKONGI IN CAMBODIA

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Abstract. We have been conducting surveys of schistosomiasis mekongi along the Mekong river in Cambodia since 1997. We attempted to detect canine schistosome infection during the survey in 2000 because dogs were reported to be natural reservoirs of the Mekong schistosome in Lao PDR. A total of 28 canine fecal samples were collected in Kbal Chuor village, Kratie Province and examined for schistosome eggs. One specimen had schistosome eggs (positive rate = 3.6%; egg density = 100/gram stool), which showed characteristics of *Schistosoma mekongi*. During the 2001 survey, one out of 310 canine stool samples was positive for schistosome eggs (positive rate = 0.32%; egg density = 3,456/gram stool). These are the first confirmed cases of canine schistosomiasis mekongi in Cambodia, which suggests that dogs are animal reservoirs of *S. mekongi* in the survey area. We further tried to detect *S. mekongi* in cows, water buffalos, pigs, horses, and field rats in five villages in Kratie Province; no schistosome egg was found in the stools of these animals.

Schistosomiasis due to *Schistosoma mekongi* has been recognized as endemic along the Mekong river in Lao PDR and Cambodia. The disease was discovered in 1957 in Paris (Vic-Dupont *et al*, 1957) and its natural transmission was confirmed on Khong Island in the Mekong river, southern Lao PDR, some 30 km north of the border with Cambodia (Iijima and Garcia, 1967).

The first reported case of human schistosomiasis in Cambodia was in 1968 in a 12-year-old Vietnamese girl from Kratie, north-eastern Cambodia (Audebaud *et al*, 1968). Subsequent epidemiologic surveys revealed that infection was confined to the ethnic Vietnamese fishermen who inhabited raft houses or floating villages on the Mekong river in Kratie (Bazillio, 1969; Jolly *et al*, 1970a, b). Iijima

et al, (1973) conducted a schistosomiasis survey in 1968/69, using skin tests and stool examination, along the Mekong river from Stung Treng to the Vietnamese border and concluded that the disease was present in several provinces, with the highest prevalence in the province of Kratie. However, during the subsequent years of civil war and unrest, the schistosomiasis focus of Kratie was almost entirely neglected. Even after the war, surveys could be conducted only if substantial security arrangements had been made. The extent to which Cambodia was affected by schistosomiasis was unclear until Stich *et al* (1999) reported a focus of the disease in the province of Kratie; Stich *et al* (1999) went on to find that the disease was one of the most serious public health problems in the area. Since 1997, we have been conducting sero-epidemiological surveys of schistosomiasis mekongi along the Mekong river in Cambodia: we have confirmed that schistosomiasis is highly endemic in the province of Kratie, where schistosomiasis mekongi was proven to be highly endemic in our sero-epidemiological survey

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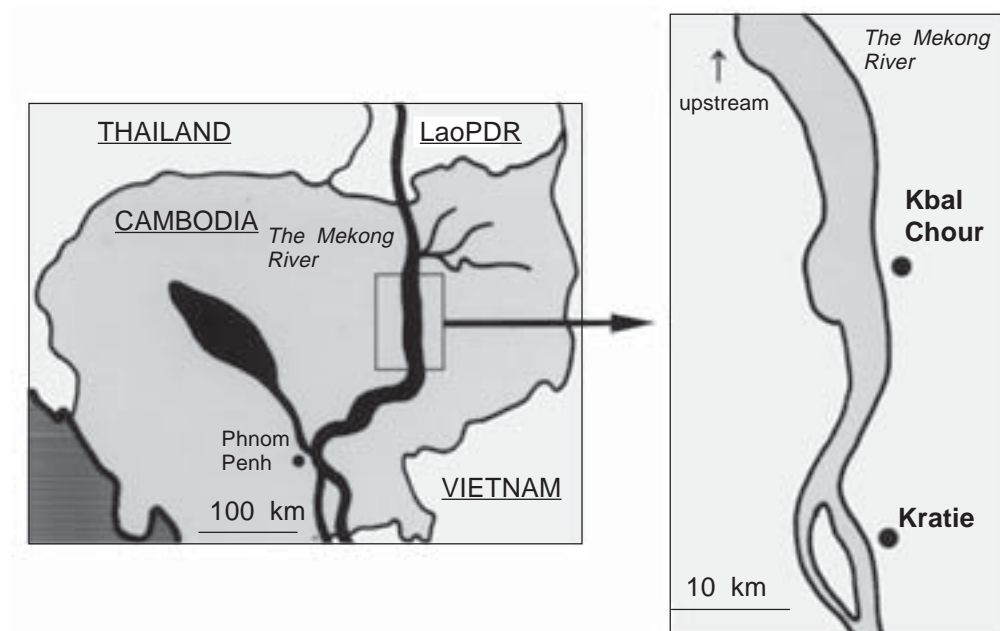


Fig 1—Kratie Province, Cambodia. A domestic dog infected with *Schistosoma mekongi* was found in Kbal Chour village.

detecting schistosome-specific antibodies: the sero-positive rate of schoolchildren in Kbal Chour village was 97.1% ($n = 70$; unpublished data).

Dogs are the only animals known to be natural reservoirs of the Mekong schistosome, but their role in the epidemiology of human infection is still unclear. On Khong Island, Lao PDR, adult worms of *S. mekongi* have been recovered from dogs, but not from rodents, pigs, cattle and water buffalos (Iijima *et al*, 1971; Sornmani *et al*, 1971; Kitikoon *et al*, 1975; Schneider *et al*, 1975). In Cambodia, however, schistosome infection in dogs has not yet been reported.

In order to determine whether dogs are reservoirs in Cambodia, we attempted to detect canine schistosome infection during our survey in 2000. A total of 28 samples of canine feces were collected in Kbal Chour village, Kratie Province (Fig 1). The fecal samples were examined by microscopy after treatment by a modified formalin-detergent technique (Waikagul

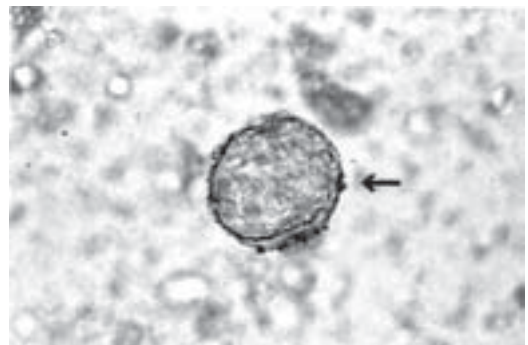


Fig 2—A *Schistosoma mekongi* egg obtained from a domestic dog from Kbal Chour village, Kratie Province. The schistosome eggs resembled a compressed ellipses (major axis: $60.68 \pm 3.21 \mu\text{m}$, minor axis: $54.93 \pm 6.29 \mu\text{m}$; average \pm SD); each had a short lateral spine (arrow), which contained a mature miracidium.

et al, 1997): we found that one sample contained schistosome eggs (positive rate = 3.6%; egg density = 100/gram stool). The eggs were typical of *S. mekongi* (Fig 2): they resembled a compressed ellipse (major axis: $60.68 \pm 3.21 \mu\text{m}$, minor axis: $54.93 \pm 6.29 \mu\text{m}$; average \pm SD)

Table 1
Other animals examined for *Schistosoma mekongi*. All stool samples were collected in May, 1998.

Village	No. of animals examined				
	Cows	Water buffaloes	Pigs	Horses	Field rats
Sambo	0	0	0	2	0
Sre Khoeun	24	12	3	0	0
Kbal Chuor	15	4	0	0	0
Roessey Char	5	0	0	0	4
Krakor	0	0	0	0	1
Total	44	16	3	2	5

and each had a short lateral spine, which contained a mature miracidium. Our finding suggested that dogs were animal reservoirs of *S. mekongi* in the survey area. This is the first confirmed case of canine schistosomiasis mekongi to be reported from Cambodia.

We continued to search for other cases of canine schistosomiasis during our 2001 survey of Kratie. A total of 310 fecal samples from domesticated dogs were collected. Well-trained inspectors from the Kratie Provincial Health Department examined the specimens for parasite eggs by the Kato-Katz technique (Katz *et al*, 1972) and found that one sample had schistosome eggs (positive rate = 0.32%; egg density = 3,456/gram stool).

We also tried to detect *S. mekongi* in other animals like cows, water buffalos, pigs, horses, and field rats, that were living in five villages in Kratie Province (Table 1). Using a modified formalin-detergent technique (Waikagul *et al*, 1997), we were unable to find any schistosome eggs in the stool of any of these other animals.

In Kratie Province, the transmission period of *S. mekongi* is the hot dry season, when the Mekong river is low and slow-moving (Stich *et al*, 1999). These conditions favor the development of the intermediate host snails, *Neotricula aperta*, which adhere to the rocks and stones that lie on the bottom of the Mekong river. We found a number of *N. aperta* that had



Fig 3—A dog swimming in the Mekong river. A number of *Neotricula aperta*, the intermediate host snails of *Schistosoma mekongi*, were stuck to rocks on the riverbed.

stuck to rocks on the riverbed; we saw domesticated dogs swimming in the river when it was very low (Fig 3). These observations led us to infer that dogs, as well as humans, become infected with *S. mekongi* mainly in the dry season and that infected dogs participate in disease transmission. Although humans appear to be the most important definitive host of the Mekong schistosome, the transmission dynamics of schistosomiasis in the survey area warrant further study. Dogs appear to play an important role in disease transmission: they are highly susceptible to *S. mekongi* infection and excrete mature eggs once infected. For the past few years, the National Malaria Center, Ministry of Health, Cambodia, has been directing chemi-

cal mass treatment operations at areas along the Mekong river that are endemic for schistosomiasis. Although such control operations are expected to reduce the human parasite burden, *S. mekongi*-infected dogs will remain untreated. Greater attention must be paid not only to patients but also to animal reservoirs, especially dogs, if schistosomiasis mekongi is to be controlled.

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