MALACOLOGICAL SURVEY IN THE SIRIKIT RESERVOIR, THE LARGEST EARTHFILLED DAM IN THAILAND

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Abstract. Ten species of freshwater molluscs were found in a malacological survey in the Sirikit reservoir in 1985. Among these species, *Tricula aperta* or *Neotricula aperta,* intermediate host of human schistosomes, *Bithynia (Digoniostoma) siamensis goniomphalos* and *B. (D.) funiculata,* the first intermediate host of *Opisthorchis viverrini* were not found.

It is revealed that most of the habitats in the Sirikit reservoir are not suitable for the survival and colonization of molluscs. Thus few species of edible molluscs in small numbers were found, except for *Limnoperna siamensis,* which were found in large numbers in the reservoir. Although it is not a medically important species, their attaching in large colonies may reduce the volume of water flowing into the power tunnels and obstruct small pipe lines in the dam area. So it is recommended to further study the life cycle of *L. siamensis* and to determine suitable molluscicides or biological agents to be used in controlling them.

INTRODUCTION

The Sirikit reservoir, the largest earthfilled dam in Thailand, is a multipurpose dam included in the Nan River basin development project. It was constructed in 1963 and finished in 1972. The main objective of this dam was to alleviate problems of electricity shortage and as a water resource to irrigate paddy fields in several provinces in the Nan and Chao Phya River basins.

Its construction resulted in a large storage water reservoir that has been in use for 20 years. As a water resource, it could potentially provide a suitable habitat for the survival of molluscs in the area and these molluscs can spread to other areas supplied by water from this dam. Some of these molluscs could possibly be of medical importance as first, second or intermediate host of human parasitic helminths. However, no base-line data were collected on the molluscan fauna before the dam was built.

Although malacological surveys have been done in every province of Thailand (Brandt, 1974), no comprehensive survey has been done specifically in the Sirikit reservoir. Thus this survey was undertaken during April 20-23, 1985.

MATERIALS AND METHODS

Areas : The Sirikit dam is located on the Nan river at Tha Pla district, Uttaradit Province, about 60 km upstream from the city of Uttaradit (Fig 1). It is an earthfilled dam with a crest elevation of 169 m above mean sea level (MSL). The dam height is 114.6 m above the river bed; the dam crest is 12 m wide and 800 m long. The maximum water level is 165.6 m above MSL; the normal water level is 160 m MSL, and the minimum water level is 128 m MSL. The maximum storage capacity of the impounded reservoir is 10,000 million m^3 (Electricity Generating Authority of Thailand, 1987).

Malacological study : The malacological survey was conducted in the Sirikit reservoir, Nan River and its tributaries. The collecting loci of molluscs were distributed principally along the edges of the Sirikit reservoir. Localities visited and collected were located at the shore and waterside between the edges of the reservoir and 5 to 10 m from the shore. The localities were about 5 to 10 km apart and were distributed to cover the entire reservoir. In the case where the ecology was favorable for the presence of molluscs, more collecting loci

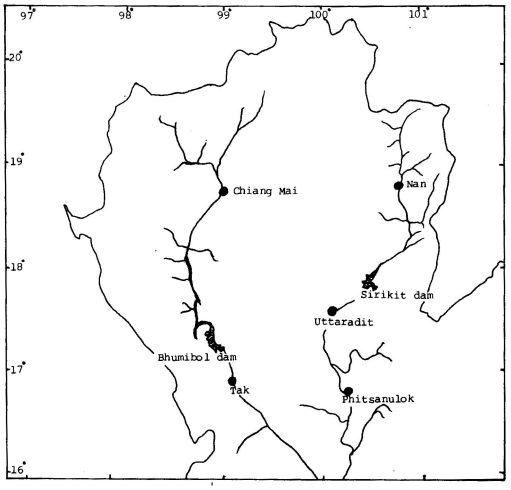

Fig 1—Location of the Sirikit dam.

were added.

Collecting techniques, time of collecting and method of study of the molluscs collected were as described previously (Temcharoen, 1992).

RESULTS

A total of 16 localities in the Sirikit reservoir, the Nan River and its tributaries in front of the dam were visited and surveyed. Ten species of molluscs were found. The results of collection and their localities are shown in Table 1. They were 7 species of freshwater snails and 3 species of freshwater clams.

DISCUSSION

According to many authors, some medically important molluscs have been found and reported in Thailand. Some of these species : *Lithoglyphopsis aperta* Temcharoen (Temcharoen, 1971; Brandt, 1974) *Tricula aperta* Temcharoen (Davis, 1979) or *Neotricula aperta* Temcharoen (Davis *et al,* 1986), the natural intermediate host of *Schistosoma mekongi* (Sornmani, 1976; Voge *et al.* 1978) has been found in the Mekong and Mun rivers, northeastern Thailand. The related species, *T. bollingi* Davis and *T. burchi* Davis (Davis, 1968; Brandt, 1974) have been found in Chiang Mai Province, northern Thailand. *Bithynia (Digoniostoma) siamensis goniomphalos* Morelet, the natural first intermediate host of *Opisthorchis viverrini* Poirier (Wykoff *et al,* 1965) and *B. (D.) funiculata* Walker, the related species, have been found and are widely distributed in the northeast and north of the country, respectively (Brandt, 1974). None of these species has been found in the Sirikit reservoir, the Nan River or its tributaries in front of the dam.

Indoplanorbis exustus Deshayes, the intermediate host of *S. spindale* Montgomery (Papasarathorn *et al,* 1963), and *Lymnaea (Radix) auricularia rubignosa* Michelin, the intermediate host of *Orientobilharzia harinasutai* (Kruatrachue *et al,* 1965), *Trichobilharzia maegraithi* (Kruatrachue *et al,* 1968) and *S. incognitum* (Bunnag *et al,*1983) are widely distributed in Thailand except in the northernmost part of the country (Brandt, 1974; Viboolyavatana *et al,* 1981). Few of *L. (R.) a. rubiginosa* were found only in Huai Lert, the Sirikit reservoir. Nevertheless, after they were shed for the larval stage of trematodes, none of them were positive for parasitic infection.

In the Sirikit reservoir, the edible molluscs, *Filopaludina (Filopaludina) sumatrensis polygramma* Martens, *F. (F.) filosa* Reeve and *F. (Siamopaludina) martensi martensi* Frauenfeld were found in some localities with muddy substrata. However, most parts of the substrata and shorelines of the Sirikit reservoir consist of rocks, gravel and tree stumps. These habitats are not suitable for the survival and colonization of most molluscs. Nevertheless, surveys in the Sirikit reservoir revealed many colonies of *Limnoperna siamensis* Morelet in all study areas. They are attached by their byssus in large colonies in the fractures or holes of rocks, stones, gravel, tree stumps and almost everything submerged in water. Although *L. siamensis* has not been reported as a medically important species, it has to be carefully studied because they may occur in large colonies fastening their byssus to the power tunnels, decreasing the volume of water flowing into the power tunnels or obstructing small pipe-lines in the dam area. They also consume phytoplankton and zooplankton resulting in a reduction of nutrients available for fish in the reservoir. In order to prevent accumulation of this clam, it is necessary to investigate the life cycle of *L. siamensis* including its attachement, spawning time, etc and also to determine suitable molluscicides which might be used in controlling either larval of adult *L. siamensis.* Biological con-

Table 1

Malacological survey in the Sirikit reservoir and tributary streams, April 1985.

Species	Localities															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Freshwater snails																
Family Viviparidae Gray																
Filopaludina (Filopaludina) sumatrensis polygramma Martens	02+2	-	-	02+2	-	-	-	-	-	-	-	-	-	-	01+1	02+2
F. (F.) filosa Reeve	03+3	-	-	-	-	-	-	01+1	-	-	-	-	03+3	-	-	-
F. (Siamopaludina) M. martensi Frauenfeld	03+3	-	01+1	02+2	-	-	-	02+2	-	-	-	-	03+3	-	-	02+2
Family Thiaridae Gray																
Thiara scabra Muller	-	-	-	-	-	-	-	-	-	-	-	-	-	-	01+1	-
Family Buccinidae Fleming																
Clea (Anentome) helena Philippi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	01+1	-
Family Lymnaeidae Gray																
Lymnaea (Radix) auricularia rubiginosa Michelin	-	-	-	-	-	-	-	-	-	-	-	-	01+1	-	-	-
Family Planorbidae Gray																
Gyraulus rotula Benson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	02
Freshwater clams																
Family Amblemidae Rafinesque																
Pilsbryoconcha exilis compressa Martens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	01+1
Family Mytilidae Refinesque																
Limnoperna siamensis Morelet	04+4	04+4	04+4	04+4	04+4	04+4	04+4	04+4	04+4	04+4	04+4	04+4	04+4	04+4	04+4	04+4
Family Corbiculidae Gray																
Corbicula lamarckiana Prime	-	-	-	-	-	-	-	-	-	-	-	-	-	01+1	-	-

Notes : Number of molluscs collected or found

+1 = 1-10 living specimens.	01 = 1-10 dead specimens.
+2 = 11-50 living specimens.	02 = 11-50 dead specimens.
+3 = 51-100 living specimens.	03 = 51-100 dead specimens.
+4 = over 100 living specimens.	04 = over 100 dead specimens.

trol agents should also be considered.

REFERENCES

Brandt RAM. The non-marine aquatic mollusca of Thailand. *Arch Molluskenk* 1974; 105 : 1-423.

Bunnag T, Thirachandra S, Impand P, Vorasanta P, Imlarp S. *Schistosoma incognitum* and its zoonotic potential role in Phitsanuloke and Phichit Provinces, northern Thailand. *Southeast Asian J Trop Med Public Health* 1983; 14 : 163-70.

Davis GM. New *Tricula* from Thailand. *Arch Molluskenk* 1968; 98 : 291-317.

Davis GM. The origin and evolution of the gastropod family Pomatiopsidae with emphasis on the Mekong river Triculinae. *Monogr Acad Nat Sci Philadelphia,* 1979; 20 : 1-120.

Davis GM, Rao NVS, Hoagland KE. In search of *Tricula* (Gastropoda : Prosobranchia) : *Tricula* defined, and a new genus described. *Proc Acad Nat Sci Philadelphia* 1986; 138 : 426-42.

Electricity Generating Authority of Thailand. Post impoundment evaluation and development planning of the Bhumibol and Sirikit project, 1987; 2 : main report, 1-470.

Kruatrachue M, Bhaibulaya M, Chesdapan C, Harinasuta C. *Trichobilharzia maegraithi* sp. nov., a cause of cercarial dermatitis in Thailand. *Ann Trop Med Parasitol* 1968; 62 : 67-73.

Kruatrachue M, Bhaibulaya M, Harinasuta C. *Orientobilharzia harinasutai* sp. nov., a mammalian blood-fluke, its morphology and life cycle. *Ann Trop Med Parasitol* 1965; 59 : 181-8.

Papasarathorn T, Tongkoom B, Hiraniramon S, Ito J. On the discovery and prevalence of *Schistosoma spindale* (Montgomery, 1906) in Thailand. *Jpn J Med Sci Biol* 1963; 16 : 39-43.

Sornmani S. Current status of research on the biology of Mekong *Schistosoma. Southeast Asian J Trop Med Public Health* 1976; 7 : 208-13.

Temcharoen P. New aquatic molluscs from Laos. *Arch Molluskenk* 1971; 101 : 91-109.

Temcharoen P. Malacological survey in the Bhumibol reservoir, the first dam constructed in Thailand. *Southeast Asian J Trop Med Public Health* 1992; 23 : 103-10.

Viboolyavatana J, Sumethanurugkul P, Chearanai S. Studies on the distribution of snail intermediate host of parasitic infection in Thailand. *Southeast Asian J Trop Med Public Health* 1981; 12 : 200-3.

Voge M, Bruckner D, Bruce I. *Schistosoma mekongi* sp. n. from man and animals, compared with four geographic strains of *Schistosoma japonicum. J Parasitol* 1978; 64 : 577-83.

Wykoff DE, Harinasuta C, Juttijudate P, Winn MM. *Opisthorchis viverrini* in Thailand; the life cycle and comparison with *O. felineus. J Parasitol* 1965; 51 : 207-14.

APPENDIX

Description of the localities visited in the Sirikit reservoir, Nan River and its tributaries, Tha Pla District, Uttaradit Province as shown in Table 1.

1. The shore at the fish loading in the second basin of the Sirikit reservoir, Tha Pla district, Uttaradit Province.
2. The shore of the Sirikit reservoir, on the right, about 500 m in front of the Sirikit dam.
3. The edge of the island in the middle of the first basin in the Sirikit reservoir.
4. Huai Phueng in the first basin of the Sirikit reservoir.
5. The edge of the Sirikit reservoir between the first and the second basin, The Sirikit reservoir.
6. The edge of the first basin in the Sirikit reservoir (on the stones and tree stumps).
7. The edge of the first basin in the Sirikit reservoir (clay valley and tree stumps).
8. The edge of the Sirikit reservoir at the beginning of the second basin (stones valley).
9. The edge of the Sirikit reservoir in the second basin (mountainous rocks).
10. The edge of the Sirikit reservoir in the second basin with mountainous rocks and small gravel.
11. The edge of the Sirikit reservoir at the junction between Huai Lert and the Sirikit reservoir, the second basin.
12. The edge of Huai Lert, on the way from the second basin of the Sirikit reservoir to Huai Lert.
13. The beginning of Huai Lert (the stream flows into the second basin of the Sirikit reservoir).
14. Huai Lert at the ruined temple.
15. Phra waterfall near the edge of the second basin of the Sirikit reservoir, Nang Phya village.
16. The edge of the island in the second basin, about 3 km from the saddle of the Sirikit dam.