SURVIVAL OF BETA AND GAMMA RACES OF *NEOTRICULA APERTA* SNAIL INTERMEDIATE HOSTS OF *SCHISTOSOMA MEKONGI* IN RAW WATERS

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Abstract. Beta and gamma races of *Neotricula aperta* were exposed to naturally raw waters of the Sirindhorn reservoir, Mun River and Mekong River in laboratory conditions and non supplement on food. Snails of two races could withstand well in variable qualities of water within 48 hours. The survival rates of *N. aperta* in three sources of raw water were 100% for the beta race and 97 to 100% for the gamma race.

INTRODUCTION

Population of *Neotricula aperta* Davis (1986), former nomenclatures *Lithoglyphopsis aperta* Temchareon (1971) and *Tricula aperta* Temchareon (Davis, 1979), in the lotic habitats of Ubon Ratchathani Province, northeastern Thailand has been recognized since the late 1970s. This snail is categorized as one of 18 freshwater snail species which are medically important mollusks in Thailand (Burch and Lohachit, 1983; Burch and Upatham, 1989). The gamma race of *N. aperta* appears to be the natural snail intermediate host of *Schistosoma mekongi* Voge, Brucker and Bruce, 1976 (Kitikoon *et al*, 1973; Sornmani *et al*, 1973) while the alpha and beta races of this snail can be experimentally infected (Sornmani, 1976; Lohachit *et al*, 1981; Kitikoon, 1981). Naturally, the *N. aperta* snail itself is also an important link in the food web relationships of the lotic ecosystems in the Mekong and Mun Rivers as well.

The Pak Mun Dam was constructed at the lower Mun River where 12 habitats of the beta race of *Neotricula aperta* have been reported (EGAT, 1982). Snail habitats have already been flooded by the water impoundment since May 1994. Thus, the natural history on *N. aperta* habitat was changed from a lotic environment to a lentic condition.

In an affort to gain new perspective on the adaptation of *Neotricula aperta* from lotic to lentic environment, we therefore present our investigation on the survival of this snail in the naturally raw waters. This investigation was concurrent with an investigation on the opportunity of *N. aperta*, snail intermediate host of *Schistosoma mekongi* to colonize in the reservoir and a survey for schistosomiasis in the vicinity of reservoir of Sirindhorn Dam, Ubon Ratchathani Province (Sornmani, 1994).

MATERIALS AND METHODS

Snail specimens

Neotricula aperta snails were collected from two freshwater localities during early May 1993, in Ubon Ratchathani Province, northeastern Thailand. The beta race of *N. aperta* was obtained at the Pak Mun Dam Site, approximately 500 m uptream to the constructing dam, in the Mun River. The gamma race snails were collected from the Khong Chiam District, in the Mekong River. Snails were ranging in size from 1.4 mm to 3.7 mm long for the beta race and from 0.8 mm to 1.1 mm long for the gamma race.

Sources of water

Raw water was obtained from three natural sources. The first water sample was taken from the habitat of the beta race of *Neotricula aperta* in the Mun River. The second water sample was obtained from the Mekong River, at the Khong Chiam District where the gamma race snails were collected. The last water sample was taken from the dam site area of the Sirindhorn reservoir.

All water samples were collected at 1m depth, stored in plastic bags, placed on ice and analyzed

at field during the same period of time, between 0900 to 1100 hours. Water samples were analyzed by portable DREL/5 Model (Hach Company, USA) in order to obtain the quality variables.

Snail survivorship

Six groups of *Neotricula aperta*, 100 snails per group, were provided for survival observation in raw waters. Ten snails of each group were placed in a round glass vial of 2.5 cm × 2.5 cm which was containing 6 ml water of the Sirindhorn reservoir, the Mun River or the Mekong River. Altogether 300 beta race and 300 gamma race of *N. aperta* were used for experiment (Table 1). One replicated series of each snail race was also established. The beta race snails exposing to the Mun River water as well as the gamma race emerging in the Mekong River water were served as controls.

Snails were observed on mortality at the following time intervals : 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44 and 48 hours, which appeared to be the likely tolerated ranges for none supplement on food. Dead snails found were removed out at each time interval to minimize the snail's death from biological pollution of water. Water and room temperatures were also monitored every time interval. In studying survival, adjustments were made to determine the percentage of snail remaining.

RESULTS

Water quality

Water collected at the Sirindhorn reservoir, the Mun River or the Mekong River was variable in quality (Table 2). Generally, the river waters exhibited relatively high levels of total alkalinity, acidity, total hardness, nitrate nitrogen, calcium, sulfates and conductivity compared to the reservoir water. In the Mekong River, these chemical contents including chloride were obviously higher than those of the Mun River, but the conductivity was not so.

Snail survivorship

Regarding the survivorship of snails, most of the beta and gamma races of *Neotricula aperta* showed no death in the variable qualities of water obtained from the Sirindhorn reservoir, the Mun River and the Mekong River, in the room temperatures ranging from 22°C to 25°C and water temperatures ranging from 20°C to 24°C. Only 3 and 1 gamma race snails respectively were found dead in the Mekong River water at the 16 and 28 hours intervals. The survival rates of *N. aperta* snails in three sources of water within 48 hours observation, therefore, were 100% for the beta race and 97 to 100% for the gamma race (Table 1).

Table 1

Survival of beta and gamma races of *Neotricula aperta* in raw waters.

Natural source of raw water	Race	*Neotricula aperta*					
		Exp I			Exp II		
		Total	Dead	Survival (%)	Total	Dead	Survival (%)
Sirindhorn Reservoir	beta	100	0	100	100	0	100
Mun River	beta	100	0	100	100	0	100
Mekong River	beta	100	0	100	100	0	100
Sirindhorn Reservoir	gamma	100	0	100	100	0	100
Mun River	gamma	100	0	100	100	0	100
Mekong River	gamma	100	3	97	100	1	99

Table 2

Hydrological characteristics of the Sirindhorn Reservoir, Mun River and Mekong River at snail habitats. All units, except pH, are in milligrams per liter unless otherwise stated.

Hydrological characteristic	Sirindhorn Reservoir	Mun River	Mekong River
Temperature (C)	30	30	32
Apparent color (Units)	0	0	15
Turbidity (FTU)	2	0	4
Dissolved oxygen	6.5	7.0	7.0
Total alkalinity, as $CaCO_3$	10	40	70
Acidity, as $CaCO_3$	5	10	15
Total hardness, as $CaCO_3$	10	50	80
pH	7.1	7.8	7.8
Carbon dioxide	0.5	2.0	3.0
Ammonia nitrogen	0	0	0
Nitrate nitrogen	0.4	0.8	1.5
Nitrite nitrogen	0	0.01	0.01
Phosphate	0.08	0.01	0.20
Calcium, as $CaCO_3$	5	40	80
Sulfate	1	6	16
Chloride	1	1	15
Conductivity (micromhos/cm)	20	270	200
Total iron	0.07	0.05	0.08
Manganese	0.1	0	0.2
Copper	0.1	0.06	0.08
Hexavalent chromium	0.24	0.29	0.24
Hydrogen sulfide	0	0	0

DISCUSSION

In this study, the high survial rates of *Neotricula aperta*, both beta and gamma races, in waters of the Sirindhorn reservoir, the Mun River and the Mekong River that contained variable qualities may be explained by the snails's ability to acclimate to changes in the magnitude expected in natural waters. This could account, to some extent at least, for water quality within the usual ranges found in natural habitats not initially affecting the snails' mortality within the first 48 hours.

Various development programs in Thailand and the Mekong neighboring countries are rapidly ongoing at present and in the future. Since all three races of *Neotricula aperta* can be the snail intermediate hosts of the Mekong schistosomiasis, there is need, of field and laboratory investigations to enhance prevention and successful control of human schistosomiasis in the lower Mekong Region.

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