RESEARCH NOTE

INTERTIDAL SNAIL-TREMATODE COMMUNITIES ON THE SOUTHERN THAILAND BEFORE AND AFTER THE SOUTH ASIA TSUNAMI

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Abstract. Intertidal snail-trematode communities in southern Thailand were examined before and after the South Asia tsunami. Infection rates and species diversity of cercaria in the host snail *Cerithidea* in tidal zones did not change significantly from one year before to one month after the tsunami. However, the host snails *C. quadrata*, *C. alata* and *C. obtusa* disappeared from greatly damaged sites. It is important to follow up on the intertidal snail-trematode community recovery process after destruction of the intertidal ecosystem.

INTRODUCTION

The tsunami on December 26, 2004 caused extensive damage to many countries in South Asia. Human habitats (Wattanawaitunechai *et al*, 2005) and natural environment, such as coral reefs (Pennisi, 2005) and tidal flats, on the southwestern coast of Thailand were devastated by the tsunami (CDC, 2005). Evaluation of damage to the ecosystem and the process of recovery will provide important information for planning recovery from the environmental destruction caused by the tsunami and pollution. Since a natural disaster is unpredictable, comparison before and after the disaster is usually difficult. However, the authors had been studying snails and their parasitic trematodes in brackish areas in Thailand since 2003. Four sites on the western coast were surveyed in February 2004. Three of them were damaged by the tsunami in December 2004. The same survey of snails and their parasites was conducted at the same sites in January 2005, one month after the tsunami, in order to determine the impact of the tsunami.

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MATERIALS AND METHODS

Snails were collected in tidal flats at four sites: 1) Ban Kampuan, Suk Samran Subdistrict, Ranong Province; 2) Ban Nam Khem, Bang Muang Subdistrict, Phang-nga Province; 3) Ban Tha Din Daeng and Lam Kaen Subdistrict, Thai Muang District, Phang-Nga Province; and 4) Mangrove Research and Development Station No. 2, Wichit Subdistrict, Phuket Province (Fig 1). At the first site, Ban Kampuan, which is a fishing village, buildings and tidal flats, including vegetation, were greatly damaged by the tsunami. At the second site, Ban Nam Khem, is a large fishing

town and one of the most badly affected areas in Thailand. Almost all the houses were destroyed and many hundreds of lives were lost. Grasses and small trees were growing on the tidal flat in February 2004, but the tidal flats was covered with debris and there was no vegetation in January 2005. The third site is a small bay in which there were only four houses and several fishing boats. The damage to this site was not as great as the previously mentioned two sites. The fourth site was surveyed as a control. It is located southwest of Phuket Town and was not affected by the tsunami. Mangrove seedlings in various stages of growth were being cultured at this station.

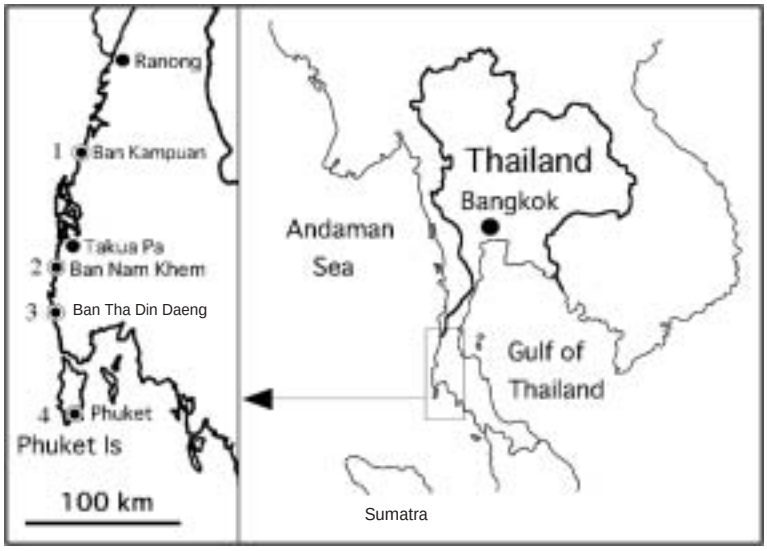

Fig 1–Map showing the surveyed sites (1-4) where snails and their parasitic trematodes were examined before and after the South Asia tsunami in 2004.

At each site, snails were collected by six persons for 30 - 60 minutes. All the snails were transported to a laboratory in Bangkok in cool boxes. After identification, part of the snails were crushed, and cercariae, sporocysts and rediae of parasitic trematodes were examined under a binocular microscope. The morphological characteristics of the larval trematodes were recorded and the infection rates were calculated.

RESULTS

Although many species of snails were collected, those belonging to *Cerithidea* were examined because these are the main intermediate hosts of trematodes in the brackish zone in Thailand (Sri-aroon *et al*, 2004). Eleven types of cercariae (Fig 2 and Table 1) were found and described as follows: type a was without eye spots or collar spines and had cystogeneous glands; type b was furcocercous type and *ogatai*-like; type c had a huge tail; type d had eye spots, a large excretory bladder and a ventral sucker, type e had a small stylet; type f was *yamagutii*-like; type g had eye spots, collar spines and cystogeneous glands; type h had a small stylet and a ventral sucker; type i had eye spots, a tail fin and 4+3 penetration glands, type j had excretory granules in a branched excretory tube, collar spines, and no fin; and type k had excretory granules in a branched excretory tube, a tail fin and no collar spine.

In January 2004 (about one year before the tsunami), the following snail species were collected at each site: *C. cingulata*, *C. quadrata, C. djadjariensis* and *C. alata* at Ban Kampuan; *C. cingulata*, *C. djadjariensis*, *C. alata* and *C. obtusa* at Ban Nam Khem; *C. cingulata*, *C. alata, C. djadjariensis* and *C. obtusa* at Ban Tha Din Daeng; and *C. cingulata*, *C. djadjariensis*, *C. alata* and *C. obtusa* at the Mangrove Research and Development Station No. 2 (Table 1). Before the tsunami, four kinds of cercariae were found only from *C. djadjariensis* at the last site. The infection rates and species diversity of

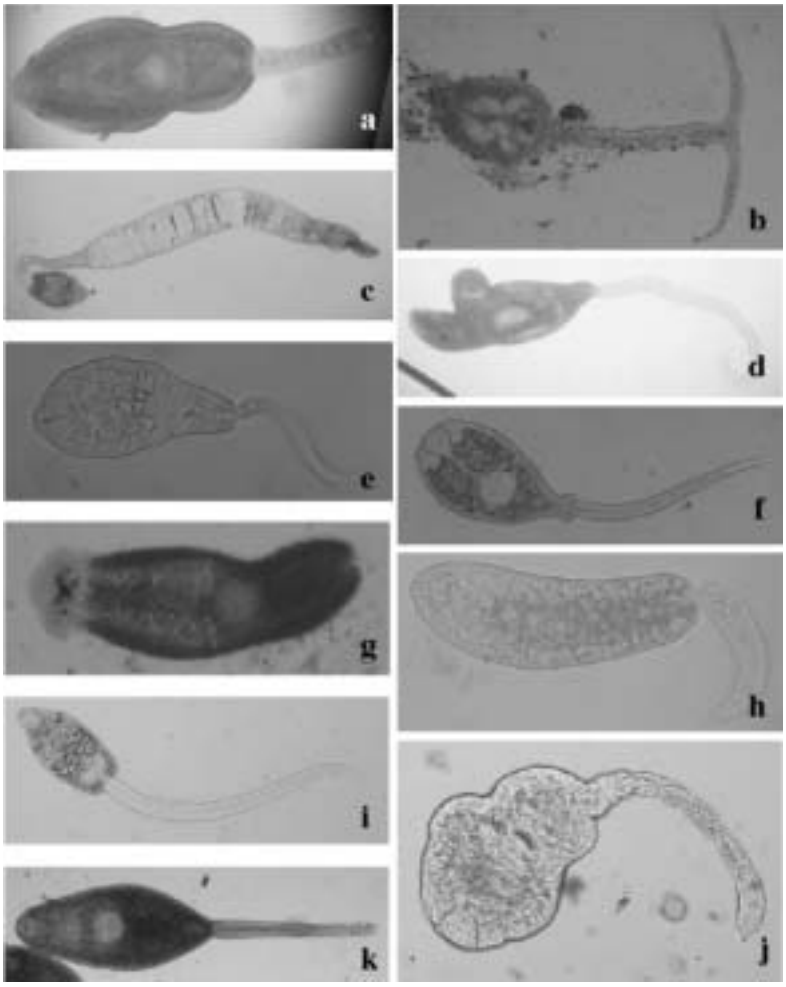

Fig 2–Eleven types of cercariae found from *Cerithidea* snails collected at four sites in southern Thailand. a - k represent types of cercaria (refer to the text for explanation).

cercariae at this site were higher than the other three sites, and the eastern sites (Sri-aroon *et al*, 2004). This site was therefore regarded as a control site with no damage by the tsunami.

After the tsunami, 4 types of cercariae were found in *C. cingulata* at Ban Nam Khem, but the differences in infection rates before and after the tsunami were not statistically significant ($p>0.05$). Although the infection rates with cercariae changed at Ban Kampuan and the control site, the differences were not statistically significant (Table 1). Thus, we found no significant differences in infection rates before and after the tsunami. However, concerning the host snails at the seriously damaged sites after the tsunami, *C. quadrata* and *C. alata* were not found at Ban Kampuan and *C. obtusa* was not found at Ban Nam Khem. Even at a slightly damaged site, Ban Tha Din Daeng, *C. djadjariensis* and *C. obtusa* were not found (Table 1).

DISCUSSION

In the survey after the tsunami, the snail

Table 1

Comparison of cercarial infections in brackish-water *Cerithidea* snails before and after the tsunami on the west-coast of Thailand.

Collection Site	Snail species	February, 2004 (Before the tsunami)			January, 2005 (After the tsunami)		
		Number of snails collected	% infection rate (positive/examined)	Cercaria type	Number of snails collected	% infection rate (positive/examined)	Cercaria type
Ban Kampuan, Suk Samran(seriously damaged)							
	Cerithidea cingulata	203	0(0/30)	-	554	1.1(1/94)	a
	C. djadjariensis	14	NE	NE	3	0(0/1)	-
	C. alata	5	NE	NE	0	-	-
	C. quadrata	2	0(0/2)	-	0	-	-
Ban Nam Khem, Bang-muang Subdistrict (seriously damaged)							
	C. cingulata	191	0(0/30)*	-	829	6.4(7/109)*	a,b,c,d
	C. djadjariensis	120	0(0/20)	-	54	0(0/12)	-
	C. alata	6	0(0/6)	-	30	0(0/19)	-
	C. obtusa	2	0(0/2)	-	0	-	-
Ban Tha Din Daeng, Lam Ke Subdistrict (damaged)							
	C. cingulata	264	0(0/30)	-	364	0(0/121)	-
	C. djadjariensis	16	NE	NE	0	-	-
	C. alata	3	NE	NE	19	0(0/4)	-
	C. obtusa	1	NE	NE	0	-	-
Mangrove Research and Development Station No.2 (Phuket) (not damaged)							
	C. cingulata	120	0(0/19)	-	106	2.9(2/70)	a,e
	C. djadjariensis	47	48(12/25)**	a,f,j,k,ud	152	32.5(13/40)**	a,e,f,g,h,ud
	C. alata	9	NE	NE	33	33.3(8/24)	a,e,f,i,ud
	C. obtusa	1	NE	NE	8	0(0/3)	-

a – i = the cercaria type, ud = undetermined, "-" = no cercaria found.

*= number positive snails/ number snails crushed, ** = Infection rates not statistically significant differences ($p>0.05$), NE = not examine.

collection efforts increased. More snails were obtained than before the tsunami and snails infected by trematodes were detected (Table 1). However, the differences in infection rates were not statistically significant. The possible causes of why a clear difference in cercaria infection was not detected may be the number of snails examined before the tsunami was insufficient or the time of the survey was too soon after the tsunami to detect a difference.

C. quadrata and *C. alata* were not found in Ban Kampuan, and *C. obtusa* was not found in Ban Nam Khem, where both villages suffered massive damage due to the tsunami. Since those snails live mainly on grasses or small trees, the destruction of these may have resulted in a loss of habitat. *C. djadjariensis* and *C. obtusa* were not found at Ban Tha Din Daeng. They may not be able to survive even in a slightly changed environment. Since the missing species, except *C. djadjariensis*, were originally few, it is unclear whether these species will re-colonize those sites in the future or not. Trematodes, especially type i cercaria, that need *C. quadrata*, *C. alata* or *C. obtusa* as their hosts, may not be able to maintain their life cycle in those areas. Since the tsunami destroyed the balance of the ecosystem of the intertidal zone of the western coast of Thailand, continued surveillance of the recovery of snail-trematode communities should be encouraged.

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