

### **Spread of infection of yellow head virus (YHV) of giant tiger prawns by cannibalism**

Intensive Penaeidae cultivation is an important industry supporting the economy in tropical regions. However, due to recent disease outbreaks and their frequency (Fig. 1), the production in cultivation farms has become unstable and as such, a prompt solution is critical. In South-East Asia, yellow head virus (YHV) is a commonly occurring viral infection in shrimp. Since the first reports of YHV in Thailand, the virus continues to cause serious damage in various places. However, the transmission mechanism of the virus is still unclear. Shrimp farmers exchange the cultivation water as seldom as possible to avoid lateral infection which in turn results in water quality deterioration and reduced productivity. In this study, we carried out experiments in order to understand the mechanisms of YHV transmission and propose measures to reduce the impact of infections.

Amongst an experimental group allowed to cannibalize infected shrimp, more than 90% of all shrimp died from severe infection within 10 days (Fig. 2, Table 1). On the other hand, significantly lower rates of YHV detection and severity were identified amongst another group sharing the aquarium water with the cannibals but separated by a filter and the death rate was also significantly lower (Fig. 2, Table 1). Moreover, the YHV severity of shrimp in the second group that had survived low level infections gradually reduced after 30 days to 60 days (Table 1). These results show that YHV infection in shrimp is more severe if the infection was caused by cannibalism than by water. The gills from shrimp that had died from YHV were collected, homogenated, and filtered at 12 and 24 hours post-mortem respectively and injected into the muscle of healthy individuals. Those injected with gills collected 12 hours post death all died within 4 days. On the other hand, only one among those injected with gills collected 24 hours post death died after 7 days (Table 2). YHV activity is still high 12 hours post-mortem but significantly reduces after 24 hours. In shrimp cultivation, the possibility of YHV infection via pond water is low; therefore, avoiding water exchange is not necessary. Furthermore, it is more important to reduce the incidence of healthy individuals feeding (cannibalizing) on other shrimp that have died from YHV infection. For example, prompt collection of deceased individuals and low-density production would be effective measures against YHV infection.

Appropriate water exchange will enhance the water quality, which in turn will enhance the expected recovery of individuals with low level infections. Greater results could be anticipated by introducing and implementing specific pathogen-free (SPF) juvenile shrimp. The mechanism of the first occurrence of YHV infection in shrimp cultivation ponds is still unknown; hence, further studies are required for a detailed understanding of YHV infection.

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Fig. 1. Giant tiger prawn infected with YHV at an earthen shrimp pond

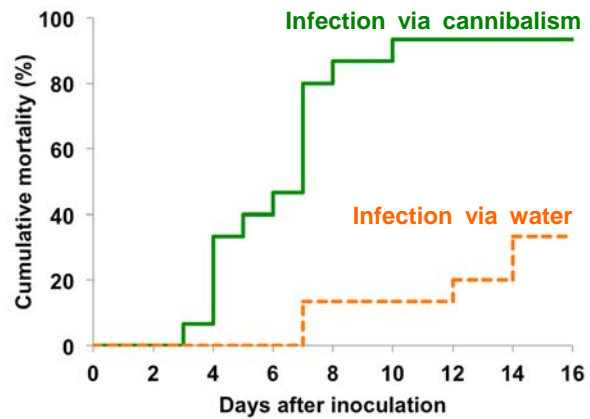


Fig. 2. Cumulative mortalities during a 16-day experiment between infected aquariums (through cannibalization and water borne routes)

Table 1. Number of deceased/surviving individuals and their infection intensity (infection through cannibalization and waterborne routes)

	Infection via cannibalism				Infection via water			
	Severely infected	Slightly infected	Undetectable	Total	Severely infected	Slightly infected	Undetectable	Total
Number of deaths	14	0	0	14	0	3	2	5
Survivors (30 days later)	0	0	1	1	0	5	5	10
(60 days later)	0	0	1	1	0	2	8	10

Deceased individuals were analyzed immediately post death. The surviving individuals were continuously raised and their infection intensity was analyzed at 30 and 60 days, respectively. Severely infectious – indicates the number of individuals that were detected positive by 1<sup>st</sup> PCR. Slightly infectious – indicates the number of individuals that were detected positive by nested-PCR. Our analyses were performed with 3 shrimps from each tank and 5 replicates for each infection route (total 15 individuals).

Table 2. Gills from individuals that had died from YHV infection were collected at 12 and 24 hours post-mortem, and the homogenate was injected into the muscle of eight healthy individuals. The number of dead/surviving individuals and their infection intensity was recorded.

	12 hours later				24 hours later			
	Severely infected	Slightly infected	Undetectable	Total	Severely infected	Slightly infected	Undetectable	Total
Number of deaths	8	0	0	8	1	0	0	1
Survivors	0	0	0	0	0	2	5	7

Dead individuals were analyzed immediately after death. The surviving individuals were analyzed at 16 days.