Status of mosquito larvae and water qualities in shrimp ponds in Trang province

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ABSTRACT

This research aimed to study the mosquito larvae and water qualities in shrimp ponds in 3 districts (Palian, Yan Ta Khao and Hat samran) of Trang province. A total of 31 shrimp ponds were sampled in February 2018. The mosquito larvae were sampled from a shrimp pond using a one liter dipper and preserved the mosquito larvae in 90% ethanol in the laboratory. We recorded water qualities (pH, salinity, conductivity, temperature and dissolved oxygen) in each pond. We identified the mosquito larvae up to genus level and counted the numbers. The results show that mosquito larvae (only *Culex* spp.) were present only in 9 ponds among 31 ponds, and mosquito larvae numbers did not differ among these 9 ponds. Mosquito larvae were found in Palian (1241 *Culex* mosquito) and Hat samran (589 *Culex* mosquito) districts. Salinity and temperature were higher in the ponds with mosquito larvae than in the ponds without mosquito larvae (Salinity: $t = 3.03$, $P < 0.01$; Temperature, $t = 0.88$, $P < 0.05$). Other parameters did not differ between ponds with and without mosquito larvae. Salinity, conductivity and temperature were positively correlated with the numbers of *Culex* spp. A total of 283 mosquito larvae were recorded belonging to 4 types in households near shrimp ponds, which included *Culex* spp. (185), *Aedes albopictus* (91), *Aedes aegypti* (7), and *Toxorhynchites* spp..

Keywords: shrimp ponds, mosquito larvae, water quality

Introduction

Mosquitoes are found around the world, especially throughout the tropics and in warmer regions. They thrive in a variety of habitats, including freshwater and brackish water (Clear and polluting) (Rueda, 2008). Mosquitoes are commonly known to be a major threat to public health. Biological diversity of mosquitoes is manifested by the fact that many of the genera have spread around the world and some of them are endemic. Mosquitoes are responsible for various diseases in human beings, such as malaria, chikungunya, elephantiasis, dengue fever and Japanese encephalitis (Gratz, 2004; Carrieri et al., 2011; Kaliwa et al., 2011). Almost 700 million people suffer from mosquito-borne diseases every year (Caraballo et al., 2014)

Mosquito habitats have unique ecological properties, and these habitats may be natural habitats, such as tree and leaf litter, or man-made artificial habitats such as tires, plastic cups, and water tanks (Sim et al., 2012). Controlling of mosquito habitats and breeding sites is one of the most effective ways to control mosquito-borne diseases (Sigh et al., 2006).

In Trang province, there are many shrimp farms and the size of each pond is several square meters. Shrimp ponds could be used as breeding sites by mosquitoes. We would like to know the status of mosquito larvae and water qualities in shrimp ponds in Trang province.

Research Questions

1. What types of mosquito larvae are found in shrimp ponds?
2. How about the numbers of mosquito larvae in shrimp ponds?
3. Does water quality affect the type and number of mosquito larvae in shrimp ponds?

Research Methodology

1. Study area

The study sites (Palian, Yan Ta Khao and Hat Samran Districts) were located in Trang province, southern Thailand (7° 33' 22.79" N and 99° 36' 41.08" E) (Figure 1). The study was conducted in February 2018.

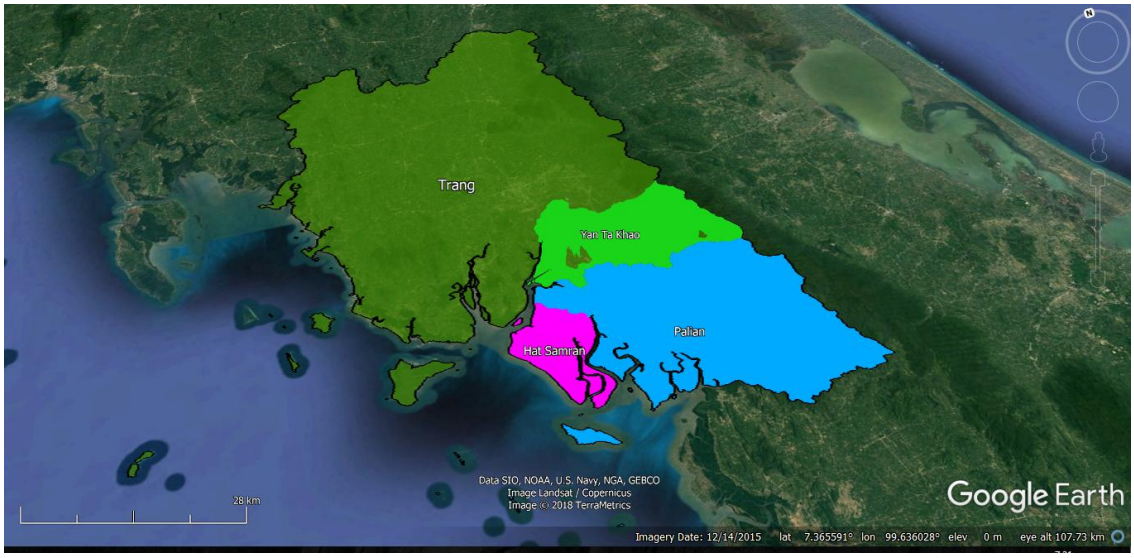

Figure 1: Map of the study sites (Palian, Yan Ta Khao and Hat Samran Districts) in Trang province

2. Data collection

We randomly selected 31 shrimp ponds in 3 districts and collected mosquito larvae based on the GLOBE mosquito protocols. The latitude, longitude and elevations of shrimp ponds were recorded using smartphone App.

3. Mosquito larvae collection, preservation and identification

We collected 1 liter of water with 3 replicates from each pond and collected all mosquito larvae from that water. We recorded water qualities (pH, Salinity, Conductivity, DO and temperature) of each pond. We found mosquitoes in 9 ponds among 31 ponds. All mosquito larvae from each pond were placed in a plastic bag and tied the bag with a rubber band (Chumsri et al. 2015). We preserved mosquito larvae in 90% alcohol in the laboratory and identified them up to genus level using Rattanarithikul and Panthusiri's keys (Rattanarithikul et al. 1994).

4. Data analysis

Independent sampled t-tests were used to test the differences in water qualities between shrimp ponds with and without mosquito larvae. One way ANOVA test was used to test the differences in the numbers of *Culex* spp. among ponds with mosquito larvae. Spearman correlations were used to test the associations between the water qualities and the number of *Culex* spp. larvae. The significant tests were two-tailed with significant level at $P<0.05$.

Results

Number of mosquito larvae in shrimp ponds

Mosquito larvae were found in 9 ponds among 31 ponds, and they were found in Palian and Hat Samran districts. In these shrimp ponds, only one mosquito species (*Culex* spp.) was found (Table 1).

Table 1 Number of shrimp ponds and number of mosquito larvae

District	Shrimp pond with mosquito larvae		Shrimp pond without mosquito larvae	
	No. of Pond	No. of *Culex* spp. mosquito larvae	No. of Pond	No. of mosquito larvae
Palian	4	1,241	12	0
Yan Ta Khao	0	0	10	0
Hat Samran	5	589	0	0
Total	9	1,830	22	0

Water quality between shrimp ponds with and without mosquito larvae

Salinity and temperature were higher in the ponds with mosquito larvae than in the ponds without mosquito larvae. Other parameters did not differ between ponds with and without mosquito larvae (Table 2).

Table 2 Water quality parameters between shrimp ponds with and without mosquito larvae

Water quality parameters	Mean ± SE		*t*-test
	Shrimp pond with mosquito larvae	Shrimp pond without mosquito larvae	
pH	8.21± 0.83	8.28 ± 0.35	$t_{91} = 0.88$, $P > 0.05$
Salinity (ppt)	17.56 ±0.92	14.12 ± 0.66	$t_{91} = 3.03$, $P < 0.01^{*}$
Conductivity (µs/cm)	15306.93 ± 493.03	14132.32 ± 477.95	$t_{91} = 1.45$, $P > 0.05$
Temperature (°C)	32.21±0.26	31.46±0.16	$t_{91} = 0.88$, $P < 0.05^{*}$
DO (ppm)	6.71 ±0.13	6.96 ± 0.13	$t_{91} = 1.13$, $P > 0.05$

The number of mosquito larvae in shrimp ponds

The number of mosquito larvae were not different among the ponds with mosquito larvae (Table 3).

Table 3 The numbers of *Culex* spp. larvae in shrimp ponds

Ponds with mosquito larvae	No. of *Culex* spp. larvae (Mean ± SE)	One-way ANOVA test
Pond1	12.00 ± 10.07	$F_{8,18} = 1.51$, $P > 0.05$
Pond2	91.33 ±91.33	
Pond3	202.00 ± 119.03	
Pond4	108.33 ± 22.81	
Pond5	104.67±31.39	
Pond6	37.33±7.51	
Pond7	36.33±25.31	
Pond8	17.67±16.67	
Pond9	0.33±0.33	

Relationship between number of *Culex* spp. mosquito larvae and water quality of shrimp ponds with mosquito larvae

Mosquito larvae numbers were positively correlated with salinity, conductivity and temperature (Table 4)

Table 4 Relationships between *Culex* spp. larvae numbers and water quality parameters in Trang province ($N = 27$)

Mosquito larvae	**Water quality parameters**				
	pH	Salinity (ppt)	Conductivity (µs/cm)	Temperature (°C)	DO (ppm)
***Culex* numbers**	$R = 0.35$, $P > 0.05$	$R = 0.55$, $P < 0.005$	$R = 0.58$, $P < 0.005$	$R = 0.42$, $P < 0.035$	$R = 0.21$, $P > 0.05$

Type and number of mosquito larvae in household near shrimp pond

A total of 283 mosquito larvae were recorded belonging to 4 types, which included *Culex* spp. (185), *Aedes albopictus* (91), *Aedes aegypti* (7), and *Toxorhynchites* spp. (Table 5).

Table 5 Type and number of mosquito larvae in shrimp ponds

District	Types of mosquito larvae species			
	Aedes aegypti	*Aedes albopictus*	*Culex* spp	*Toxorhynchites* spp
Hat samran	7	79	179	1
Palain	0	12	6	0
Yan ta khao	0	0	0	0
Total	7	91	185	1

Discussion

We found only *Culex* spp. in shrimp ponds and the number of mosquito larvae did not differ among ponds with mosquito larvae. It seems that other mosquito species do not prefer shrimp ponds as their breeding sites in southern Thailand. Among water qualities, salinity and temperature were higher in the ponds with mosquito larvae than in the ponds without mosquito larvae. Other parameters did not differ between ponds with and without mosquito larvae. Salinity, conductivity and temperature were positively correlated with the numbers of *Culex* spp. According to Bailey (1989), temperature condition is the most important factor among many factors for the survival and growth of the organisms that stay in water for any phase of their life cycles.

Conclusion

This research report the specie of mosquitoes in shrimp pond and in containers around the houses. We can prove that dengue fever was not come from mosquito in shrimp pond like people in local area believed but it might be came from the house around the ponds. Control mosquito larvae indoor and outdoor in household will control dengue fever.

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