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Aedes aegypti Larval Habitats and Dengue Vector Indices in a Village of Ubonratchathani Province in the North-East of Thailand

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Abstract

The objectives were to survey *Aedes aegypti* larval breeding habitats and analyze dengue vector indices.This larval vector survey was conducted in Dongklang village in Ubon Ratchathani province over two years in 2012 and 2013. During each year, dengue vector indices, House Index (HI), Container Index (CI), and Breteau Index (BI), were collected for two periods, dry season (January-April) and wet season (May-August). The number of households infested with larvae in the different years and periods were compared using chi-square test. The results showed in 2012, HI, CI, and BI were 52.7%, 19.9%, and 135.1% respectively in the dry season. In the wet season, the indices decreased. In 2013, dengue vector indices again tended to decrease from dry seasonal to wet seasonal periods. The numbers of households that were infested by *Aedes* larvae did not differ between years and seasons. Dengue vector indices are alternative methods to predict *Aedes* mosquito distribution and can be used in the making of decisions in relation to the development of health systems, planning, prevention, and control of dengue infection
Keywords: *Dengue vector indices, Aedes aegypti larvae, Breeding habitats*

1. Introduction

Dengue is a major public health problem that is spread by *Aedes aegypti* mosquitoes and occurs annually. There are four dengue virus serotypes, thus the dengue infection can be repeated. Dengue outbreaks occur during the wet season and are associated with humidity and temperatures (1,2). *Aedes aegypti* mosquitoes usually breed in indoor and outdoor water environments, including water-holding containers such as vases, jars, bathtubs, tires, garden debris, leaves, and flowerpots (3,4). Pupa and adults remain in the dark wall and always live in areas close to their breeding sites. The mosquitoes usually bite in the daytime.

The Ministry of Public Health of Thailand encourages people to get rid of water receptacles in the general community that provide sites for breeding of mosquitoes. However, environmental factors such as rainfall, increasing temperatures, forests, and agricultural areas support *Aedes aegypti* breeding.

The occurrences of *Aedes aegypti* and dengue fever can be predicted by the use of House Index (HI), Container Index (CI), and Breteau Index (BI) (3), indices that are accepted by the World Health Organization (WHO) in the forecast of dengue outbreaks. This study found that HI ≥ 10 or BI ≥ 50 were indicators of a higher risk of disease (5).

Donklang village in Warin Chamrap district of Ubon Ratchathani province is considered as a high density community with houses located close to each other. There is a school and temple located in the center of the village. These factors support the breeding of *Aedes aegypti* and the spread of dengue fever. Thus the village has a high risk of disease infection(5). The present study aims to explore *Aedes aegypti* breeding habitats and analyze the indices to assist in the planning and prevention of *Aedes aegypti* breeding and outbreaks of dengue fever.

2. Material and methods

2.1 Study Area

Donklang village is located at 15° 8′ 14.90″ north and 104° 53′ 14.16″ east of Ubon Ratchathani, Thailand. The average rainfall, and temperature for 2012 to 2013 were 1,705.9 mm., and 40.1°C respectively (6). The study site contained 179 households and 825 people.

2.2 Larval Vector Survey

A larval vector survey was conducted over a two-year period in 2012 and 2013. The one hundred and seventy -nine households were purposively surveyed. Dengue vector indices, HI, CI, and BI were collected in the dry seasons (January-April) and wet seasons (May-August) by using WHO standard method; the Visual Larval Survey (7) to indicate the density of mosquitoes. These indices are the indicators of association between household, containers, and are considered to be the most informative measures of mosquito density levels. For the containers, all of the natural and artificial containers in every household either indoor or outdoor were inspected to determine the presence or absence of *Aedes aegypti*. These larval vectors surveys by staff of Bua Wat Tambon Health Promoting Hospital, Ubon Ratchathani province.

2.3 Data Analysis

Data related to the dengue vector indices were collected according to the percentage of houses infested with larvae (HI), the percentage of containers infested with larvae (CI), and the number of positive containers per 100 houses inspected (BI). According to the National Institute of Communicable Diseases (2001) (5), the evaluation of risk of dengue is high when HI and CI are ≥10 or BI is ≥50, and there is a low risk when HI and CI are ≥1 or BI is ≥5. The numbers of households infested with larvae in different years and seasons were compared using chi-square test using the R software program. Statistical significance was defined as a two-tail P value <0.05.

3. Results and discussion

3.1 Results

In the 2012 dry season, the survey found that the *Aedes* larval breeding habitats in cement tank, ant trap, and water jar were 43.5%, 19.3%, and 16.2% respectively and wet seasons found in natural containers, water jar, and cement tank were 9.2%, 3.6%, and 1.3% respectively. In 2013 dry season, our result show that flower vase (33.3%), and water jar (16.9%) as primary breeding habitats for *Aedes* larval. In 2013 wet season are presented in Table 1. In the 2012 dry season, the survey found that the dengue vector indices for HI, CI, and BI were 52.8%, 19.9%, and 135.2% respectively. In the 2012 wet season, the dengue vector indices decreased. In 2013, the dengue vector indices tended to decrease from the dry season to the wet season (Table 2).

Table 1. Number and percent of *Aedes* larval breeding habitats.

Container breeding site	year 2012				year 2013			
	Dry season		Wet season		Dry season		Wet period	
	Containers surveyed	Containers found with *Adedes* larvae (%)	Containers surveyed	Containers found with *Adedes* larvae (%)	Containers surveyed	Containers found with *Adedes* larvae (%)	Containers surveyed	Containers found with *Adedes* larvae (%)
Water jar	370	61(16.2)	280	10 (3.6)	261	44 (16.9)	308	28 (9.1)
Cement tank	108	47 (43.5)	153	2 (1.3)	39	1 (2.6)	323	27 (8.4)
Ant trap	57	11 (19.3)	20	0	34	1 (2.9)	88	1 (1.1)
Flower vase	26	0	7	0	3	1 (33.3)	37	0
Natural container/ outdoor	172	27 (15.7)	196	18 (9.2)	119	3 (2.5)	523	28 (5.4)
Total	**733**	**146**	**656**	**30**	**456**	**50**	**1279**	**84**

Table 2. Dengue Vector Indices including HI, CI, and BI.

Dengue vector indices	year 2012		year 2013	
	Dry season	Wet season	Dry season	Wet season
House Index (HI)	52.8	13.1	38.6	25.0
Container Index (CI)	19.9	4.6	11.0	6.6
Breteau Index (BI)	135.2	19.6	71.4	45.7

The numbers of households that were infested by *Aedes* larvae differ seasons (Table 3).

Table 3. Different years and seasonal periods and the number of households infested with larvae.

Data	Number of households infested with *Aedes* larvae		Chi-Square	p-value
	N	Found N (%)		
Years			0.036	0.849
2012	261	29.5		
2013	254	28.7		
Seasonal period of study			43.003	0.001
Dry season	178	47.2		
Wet season	337	19.6		

3.2 Discussion

Survey results of the 2012 dry season showed that the highest numbers of *Aedes* larvae were found in containers of used water (43.5%) and drinking water (16.2%). This situation may be due to people's behavior in not turning off taps correctly and neglecting to change water in containers.

HI, CI, and BI can be used as measures of the prevalence of *Aedes aegypti* larvae. WHO called this the single-larva method, the way to collect samples of *Aedes* mosquitoes from breeding in indoor and outdoor containers (9). In the dry seasons in 2012 and 2013, it was found that the indices of *Aedes* larvae were higher than in the wet seasons, especially BI in 2012 that was higher than the standard criteria set at BI $\geq$ 50 (5). As a result, there is a higher risk of *Aedes* mosquitoes and outbreaks of dengue fever. During the wet season, the dengue vector index decrease but the wet seasons are characterized by increased outbreaks of dengue fever (1,2). Therefore, public health agencies including the Office of Disease Prevention and Control, health promotion district hospitals, and public health volunteers are required to coordinate dengue prevention campaigns and destruction of *Aedes* larval breeding sites to counteract outbreaks in wet season. Also, the provision of thermal fog generators in villages, the use of temophos sand granules to destroy *Aedes* larvae in water containers, and the changing of water in containers on a regular basis need to be encouraged to help reduce the risk of dengue fever outbreaks (8). However, the *Aedes* larvae index remains high in both seasons. Hence, it is necessary to destroy the mosquito breeding sites and for villagers to protect themselves against mosquito bites because of reports that *Aedes* mosquitoes can fly 30 to 400 meters (10).

The presence of *Aedes* larvae in households did not differ over the two years and seasons of the study. This may have been due to the similarity of annual rainfall, humidity, and temperature conditions in Donklang village over the two years and because of the presence of numerous containers in different situations, providing the mosquitoes with many sites to lay their eggs. Also people did not change the water in containers regularly and, as a result, failed to destroy the *Aedes* larvae.

The relatively undeveloped community site of the study had a tropical climate appropriate for the *Aedes* life cycle (11). These were ideal conditions for breeding of *Aedes* and outbreaks of dengue (12).

Health workers and involved agencies must have knowledge, training, and continuous campaigns to counter outbreaks of dengue fever the use of index data regarding *Aedes* larvae is beneficial in the planning and decision-making to develop strategies to prevent dengue fever.

4. Conclusion

A usual destruction of *Aedes aegypti* mosquito breeding site in house and surrounding environment at least once per week would be help to reduce the spreading of *Aedes aegypti* mosquito adults. The measurement of several factors such as the rainfall, humidity, and temperature should be performed monthly or seasonally to compare the correlation between an epidemic of *Aedes aegypti* mosquito and these factors. However, there are also needs to develop the villagers' ability to monitor their houses and gardens, and the integration and coordination of village public health volunteers and relevant organizations to provide correct health knowledge and consistent advice about proper behaviors. Such developments may lead to the achievement of higher levels of sustainable health in the community.

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