Mosquito Key Breeding Sites at Bang Rong Beach Areas, Supalai Scenic Bay Resort Areas , Beach in Front of the Hotel Areas and Coral Island Areas at Phuket Province, Thailand

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Abstract

This study aimed to compare mosquito species, abundance and mosquito key breeding sites at four beaches: (1) Bang Rong Beach, (2) Supalai Scenic Bay Resort area, (3) Pakok Beach and (4) Coral Island Beach at Phuket province, Thailand. We collected mosquito key breeding sites and examined these factors: (1) Natural / Man made Containers, (2) Metal / Plastic / Earthen Containers, (3) Containers with Lid / Without Lid, (4) Water Levels (0-25%, 26-50%, 51-75%, 76-100%), (5) Water Temperature, (6) Containers / Breeding sites and (7) Mosquito species: *Aedes* (*Ae. albopictus, Ae. aegypti*), and *Culex* spp. We used the GLOBE Observer: MHM App and reported our data to the GLOBE website. Our results showed that in all the areas, we found 12 metal containers, 17 plastic containers, 13 earthen materials, 6 natural materials and 17 containers classified as other materials. In every area combined, man-made containers were higher than natural containers. Most containers are made of metal, 8 containers have lids, while 57 do not. We found that we could only find mosquito larvae in plant pots. CI in Supalai Scenic Bay Resort area most valuable.

Keywords: GLOBE Observer: MHM App, Mosquito key breeding sites, *Ae. albopictus, Ae. aegypti, Culex* spp.

Introduction

Dengue fever is a communicable disease caused by dengue virus, which consists of four serotypes: DENV-1, DENV-2, DENV-3 and DENV-4, each of which has different severity. when infected with a specific strain The body will build long-term immunity to that strain. But the immunity for the remaining 3 strains lasts only a short time, not 1 year, after which it can return to dengue again. and can be repeated up to 4 times, each time the symptoms will become more and more severe compared to the first time. It is considered a very serious disease.

Phuket province is located in Southern Thailand (Figure 1). A report in June 2018 has Phuket ranked first nationally in dengue with an average of approximately 71 cases per month between January and June 2018. The PPHO reported that from January 1, 2019 to May 2019, Phuket recorded 144 cases of dengue fever and no deaths- a morbidity rate of 35.76 per 100,000 based on the official registered population of 402,707. The national morbidity rate currently stands at 27.41 per 100,000 meaning Phuket has over 30% more cases than the national average.

In this study, we investigated (1) compare mosquito species and abundance between Bang Rong Beach areas, Supalai Scenic Bay Resort areas, beach in front of the hotel areas and Coral Island areas (2) types of key breeding sites,

To study mosquito key breeding sites at Phuket Province and examine these factors

- Natural / Man made Containers
- Metal / Plastic / Earthen Containers
- Containers with Lid / Without Lid
- Water Levels (0-25%, 26-50%, 51-75%, 76-100%)
- Water Temperature
- Breeding site Containers
- Mosquito species: *Aedes* (*Ae. albopictus*, *Ae. aegypti*), *Culex spp*.

Materials and methods

Study site

Mosquito larval survey was conducted in Phuket Province located 8.022029° N, latitude and 98.336537° E longitude in February 2023 covering three topographical areas (i.e. Bang Rong Beach areas, Supalai Scenic Bay Resort areas, beach in front of the hotel areas and Coral Island areas,) (Figure 1a,b,c,d,e).

	(b)	(c)
(a)	(d)	(e)

Figure 1.(a) Map of Thailand (b) Bang Rong Beach areas (c) Supalai Scenic Bay Resort areas (d) Supalai beach in front of the hotel areas and (e) Coral Island areas

Data collection

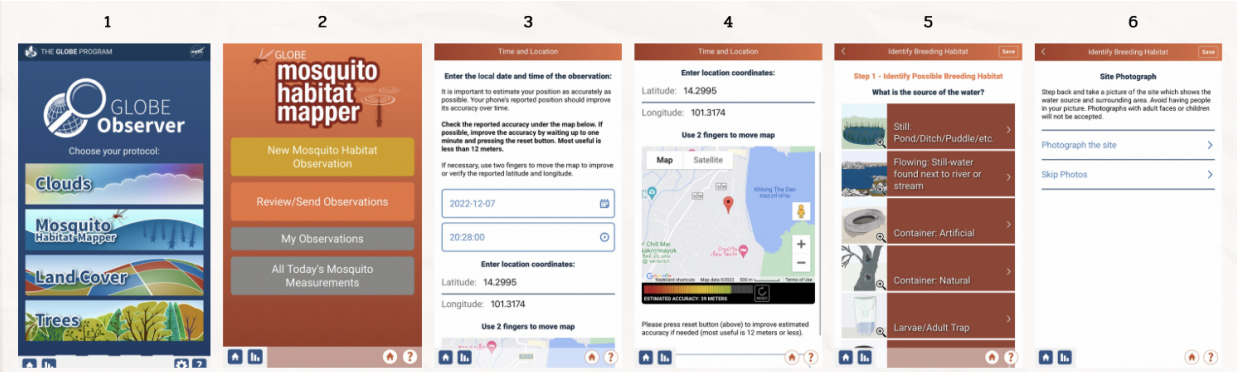
Samples were collected in Bang Rong Beach areas, Supalai Scenic Bay Resort areas, Supalai beach in front of the hotel areas and Coral Island areas using stratified simple random sampling. Topography was assigned as stratums.

1. Prepare all equipment for catching mosquito larvae.

2. Survey 4 areas: Bang Rong Beach areas, Supalai Scenic Bay Resort areas, Supalai beach in front of the hotel areas and Coral Island areas.

3. Measure the amount of water found in the container for scooping mosquitoes, put the scooped mosquitoes in a plastic bag.

4. Use the GLOBE observer: MHM app to find latitude and longitude coordinates in the area where mosquito larvae are found.



1. Choose mosquito item

2. Select the New Mosquito of observation habitat.

3,4 Observe the date and time and the latitude and longitude coordinates of the place where the mosquitoes were found.

5. Choose a container or source where mosquitoes are found.

6.Take a photo of the mosquito larvae found in the container.

Entomological studies

All water containers were sampled for mosquito larvae, between Bang Rong Beach areas, Supalai Scenic Bay Resort areas, beach in front of the hotel areas and Coral Island areas. Very small water containers were emptied through the containers. Larger water containers were sampled by dipping the net in the water, starting at the top of the container and continuing to the bottom in a swirling motion that sampled all edges of the container.[10,15] All live mosquito larvae were collected in plastic bags, taken to the laboratory, preserved and identified up to species level using Rattanarithikul and Panthusiri's[23] keys. In this study, the first and second instars and pupae were discarded because immature mosquitoes at these stages could not be identified. There were a total of 52 container categories in this study. Plastic water containers were divided into two categories: large plastic containers used for water storage (>100 L) and plastic bottles (i.e. 0.5–2.0 L water bottle).

Earthen jars were classified into two categories: small earthen jars with a volume of ≤100 L and large earthen jars with a volume of >100 L. Three larval indices (i.e. house index (HI), container index (CI) and Breteau index (BI)) were worked out as per standard WHO guidelines.

Statistical analysis

All variables were tested for normality using the Komogorov-Smirnov test. The equality of variances was evaluated using Levene's test. Descriptive statistics of the data were analysed. The numbers of mosquito larvae in different types of water containers were compared using independent samples t-tests. The number of positive containers, the number of households that had positive containers and the number of *Ae. albopictus* Larvae in Phuket province area were analyzed using a one-way ANOVA test of mosquitoes using the Chi-square test.

Results

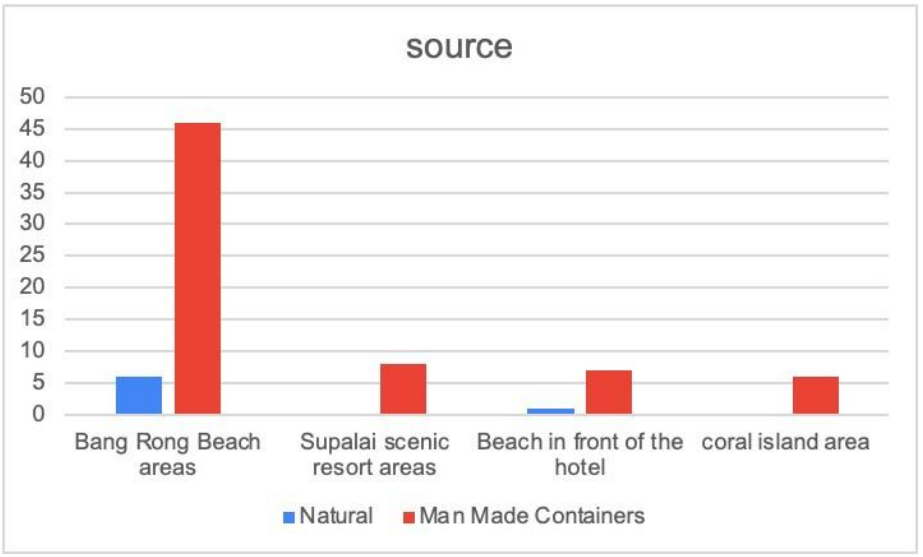
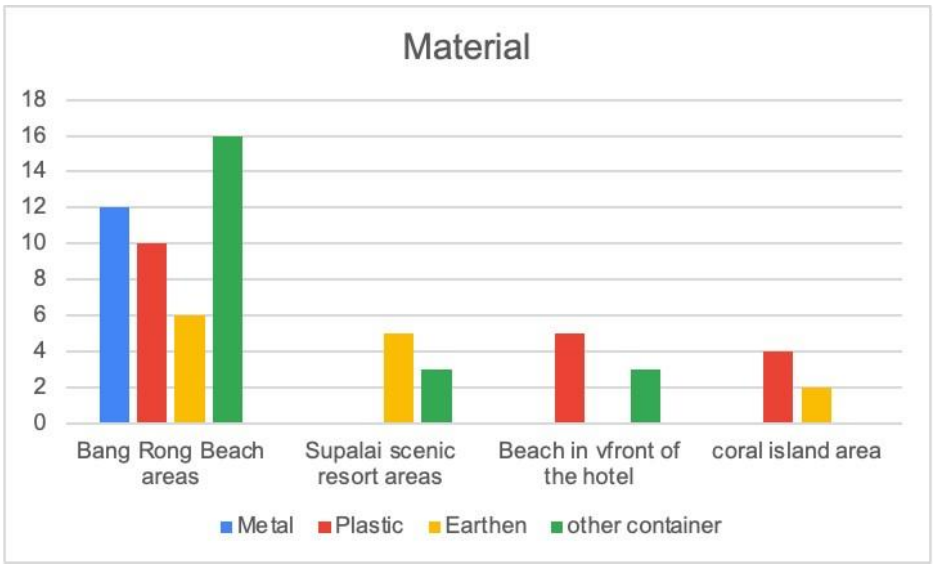
***Ae. aegypti* and *Ae. albopictus* larvae**

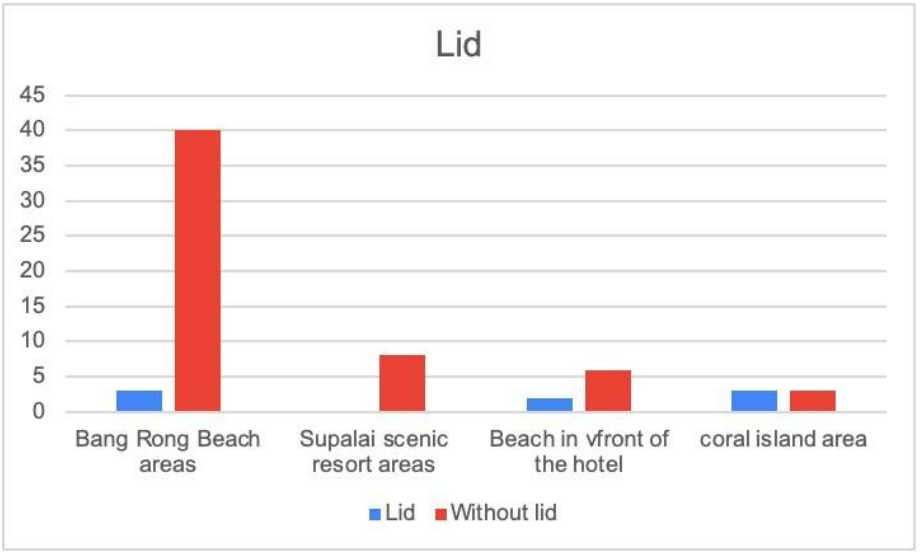
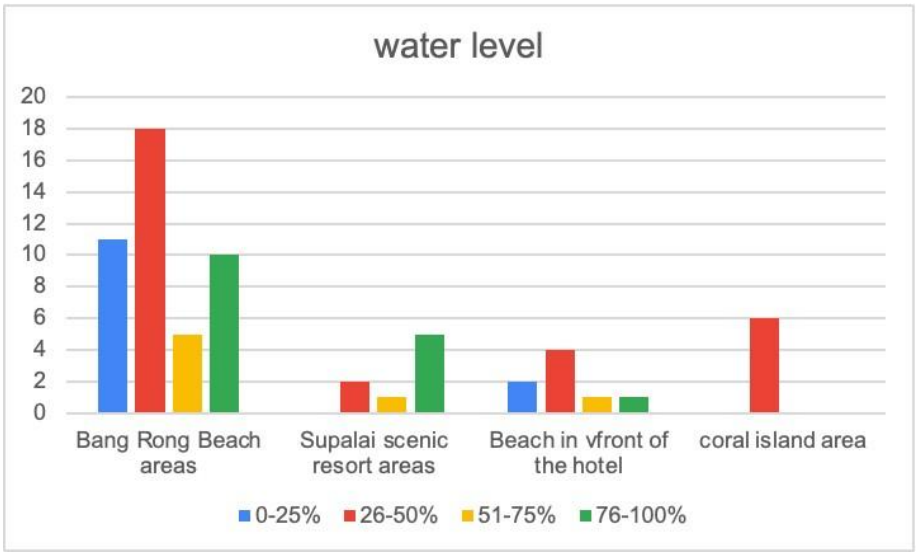
In other containers, we found 10 plastic containers, 22 earthen containers. In the Bang Rong Beach area, we found 10 plastic containers, 19 earthen containers. From all four types of water containers, we found the highest number of mosquito larvae in plastic containers (19 larvae), followed by earthen containers (13 larvae) and lowest in metal containers (1 larvae) (Table 1).

Table 1. The number of households (X ± SD) that had indoor/outdoor water containers in four topographical areas: Bang Rong Beach areas, Supalai Scenic Bay Resort areas, beach in front of the hotel areas and Coral Island areas at Phuket Province, Thailand

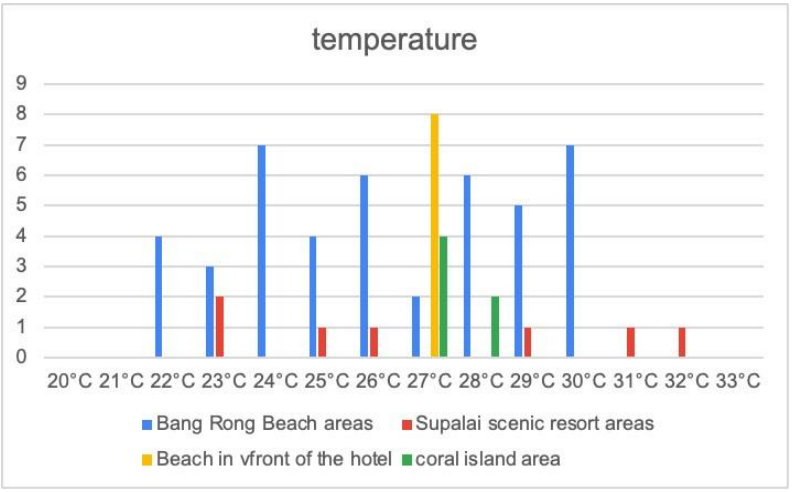
(*P<0.05,**P<0.01, ***P<0.001)

Container types	The number of water container				
	Bang Rong Beach Areas	Supalai Scenic Bay Resort Areas	Beach in front of the hotel Areas	Coral Island Areas	Number of mosquito larvae
Metal	12	0	0	0	12
Plastic	8	0	5	4	19
Earthen	6	5	0	2	13
Other container	38	3	3	0	22

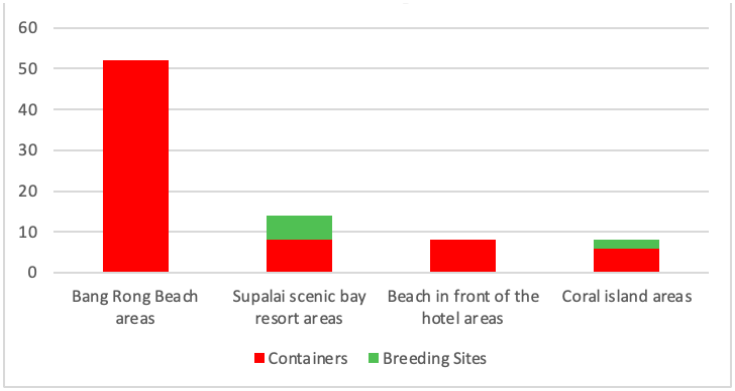
(a)	 source 50 45 40 35 30 25 20 15 10 5 0 Bang Rong Beach areas Supalai scenic resort areas Beach in front of the hotel coral island area Natural Man Made Containers
(b)	 Material 18 16 14 12 10 8 6 4 2 0 Bang Rong Beach areas Supalai scenic resort areas Beach in vfront of the hotel coral island area Metal Plastic Earthen other container

(c)	 Lid 45 40 35 30 25 20 15 10 5 0 Bang Rong Beach areas Supalai scenic resort areas Beach in vfront of the hotel coral island area Lid Without lid
(d)	 water level 20 18 16 14 12 10 8 6 4 2 0 Bang Rong Beach areas Supalai scenic resort areas Beach in vfront of the hotel coral island area 0-25% 26-50% 51-75% 76-100%

(e)



(g)



(h)

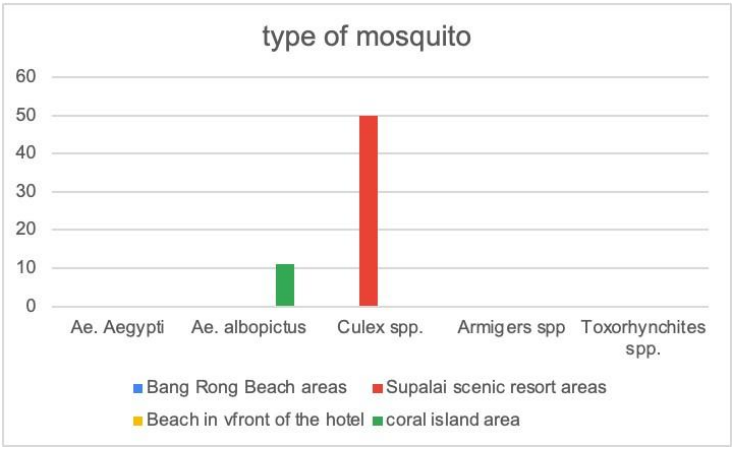


Figure 2. Water containers and mosquito larvae. (a) natural/man made container, (b) Metal/ Plastic /Earthen /Other Containers, (c) Metal/ Plastic /Earthen /Other Containers, (d) Water Levels, (e) Water Temperature, (g) Containers: Breeding Sites, and (h) *Ae. aegypti, Ae. albopictus, Culex* spp., *Armigers* spp. and *Toxorhynchites* spp.

Natural /Man made Containers

In all the areas, man made containers were higher than natural containers. In Coral Island areas, we did not find natural containers (Figure 2a).

Metal/ Plastic /Earthen /Other Containers

In the Bang Rong Beach areas, we found 12 metal containers, 8 plastic containers, 6 earthen containers, 11 other materials containers and 5 natural containers. In the Supalai Scenic Bay Hotel areas, we found 5 earthen containers and 3 other materials containers but metal, plastic and natural containers were not found in the areas. In the beach in front of the hotel areas: 5 plastic containers, 3 other materials containers and 1 natural container were found. For the last area, Coral Island, there were 4 plastic containers and 2 earthen containers while the others were not found in the area.

Other Containers

			
car tires	**puddles**	**old boats**	**coconut shells**

Lid / Without Lid Containers

In all areas, we found more containers without lids than those with lids (Figure 2c).

Water Levels (0-25%, 26-50%, 51-75%, 76-100%)

In all areas, we found most containers had a water level of 26-50% of water in the containers (Figure 2d).

Water Temperature

In Bang Rong Beach areas, water temperature in containers had an average of 26.3 °C . In the Supalai Scenic Bay Hotel area, water temperature in containers had an average of 27.1 °C. In the beach in front of the hotel areas, water temperature in containers had an average of 27°C. And in the last area, the Coral island, water temperature in containers had an average of 27.3 °C. (Figure 2e).

Containers / Breeding Sites

In the Supalai Scenic Bay Hotel area, there were a higher number of water containers and also a higher number of containers that had mosquito larvae inside (we called breeding sites) than Coral Island areas (Figure 2g).

***Ae. aegypti, Ae. albopictus, Culex* spp. , *Armigeres* spp. *and Toxorhynchites* spp.**

We found two genus of mosquito larvae present in the area *(Aedes* spp.*, Culex* spp.*, Ae. albopictus* spp.*)*. In Supalai Scenic Bay Hotel areas, we found one genus of mosquito larvae present in the area *(Culex* spp.*)*. In Coral Island areas, we found one genus of mosquito larvae present in the area *(Ae. albopictus* spp.) (Figure 2h).

Larval indices

In Bang Rong Beach areas, the number of containers and positive containers were higher than in Coral Island areas (Table 2). CI in Bang Rong Beach areas, Supalai scenic Bay Resort areas, beach in front of the hotel areas and Coral Island areas are equal (Table 2).

Table 2: This table indicates the number of households and containers, and larvae indices in Bang Rong Beach areas, Supalai Scenic Bay Resort areas, beach in front of the hotel areas and Coral Island areas.

	Bang Rong Beach Areas	Supalai Scenic Bay Resort Areas	Beach in front of the Hotel Areas	Coral Island Areas
No. of containers	34	8	7	6
No. of positive containers	0	6	0	2
Larval index				
CI (%)	0	75	0	33.33

Discussion

In the four locales of this research, there are many areas that had mosquito larvae in their water containers. Most man-made containers with plastic materials are found in Bang Rong Beach areas. We found 4 containers without lids and 40 containers with lids. We found containers that had all four types of water level.

We found a water temperature of 27°C in the Beach in front of the hotel. This might be because the containers from the rural area might be placed between the buildings, receive less direct light and have a lot of tree cover. The most common mosquito larvae are *Aedes albopictus*.

Our results support previous findings that *Culex* spp. and *Ae. albopictus* may have different key breeding sites from one area to another.[10,24] This study clearly demonstrates that *Culex* spp. and *Ae. albopictus* laid eggs in different container types depending on topographical types. Phong and Nam[23]studied *Aedes* larval occurrences in Phuket Province, Thailand and found that on the other hand, *Ae. albopictus* larvae were mainly found in jars and discarded objects. Wongkoon et al.[10] studied *Aedes* larval occurrences in Phuket Province, Thailand , and found *Culex* spp. and *Ae. albopictus* larvae in six water storage containers including pot plants, animal pans, tyres, small water jars, bathroom tanks and concrete tanks. They found that from these six containers, there were a higher number of *Ae. aegypti* larvae in water containers in bathrooms and concrete tanks than *Ae. albopictus*. [10]

Our results suggest that *Ae. albopictus* establishes well and these results support previous studies that *Ae. albopictus* inhabits forest areas. [7,9,10,13,15] There were many suitable oviposition sites located within houses in Thailand.

Larval surveillance during this study was important to find out the extent of prevalence of vectors in a locality. The HI in all topographical areas and *Aedes* species were higher than the WHO standard for high DHF risk areas (i.e. 10% HI).

I would like to claim IVSS badges

1. I make an impact

The report clearly describes how a local issue led to the research questions or makes connections between local and global impacts. The students need to clearly describe or show how the research contributed to a positive impact on their community through making recommendations or taking action based on findings. The study of mosquito larvae ecology can give the information to preserve and reduce the infection of the disease via the animal vector by reducing or changing the materials of the container.

2. I am a STEM professional.

The report clearly describes collaboration with a STEM professional that enhanced the research methods, contributed to improved precision, and supported more sophisticated analyses and interpretations of results. Data were analyzed by using independent-sampled t-tests to compare the numbers of mosquito larvae in different types of container.

3. I am a data scientist

The report includes in-depth analysis of students' own data as well as other data sources. Students discuss limitations of these data, make inferences about past, present, or future events, or use data to answer questions or solve problems in the represented system. Consider data from other schools or data available from other databases. Latitude and longitude of the area where mosquito larvae are available were recorded by using GLOBE observer, MHM application.

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