Research Title: Dengue situation with different ecological and environmental factors in the sub-district in Chiang Mai, Thailand

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Abstract: This research was conducted to study the dengue situation and environmental factors and Ecology in different sub-districts and environments in Chiang Mai Province. The objectives of the study are to gather various dengue situations, survey environmental factors impacting on ecology and factors of mosquitoes carrying dengue disease, by evaluating the mosquito larvae index in Chom Thong District, Hang Dong District and Mueang District, Chiang Mai Province. Subsequently, the information was analyzed and interpreted, and the results of the study were used as a guideline for prevention and control of dengue fever by using Montfort College School as a research base. The collected data from 98 different study sites, comprising 38 houses in Chom Thong District, 40 houses in Hang Dong District, and 20 houses in Mueang District during November 2018 to January 2019. Data analysis was made by using frequency distribution, percentage, mean and calculation of mosquito larvae index. The study indicated that the differences of community areas affect dengue fever situations and the mosquito larvae index in 3 study sites are different. Due to the characteristics of the communities in which the study site took place, it was found that different distribution characteristics and different ecological environmental factors affect the mosquito larvae index. The study indicated that the most common mosquito larvae are found in a man-made container. However, containers inside the house in the city have not been explored more thoroughly because of restrictions on the survey. For instance, the landlord of some properties went to work, making it possible to explore the outside of the house only.

KEY WORDS: Dengue situation, Mosquito larvae index, Aedes aegypti

Introduction

Background Information and Significance of the problems

Dengue fever and serious Dengue Hemorrhagic Fever (DHF) is a disease caused by mosquitoes. Dengue is spread through the bite of the female mosquito (Aedes aegypti); the mosquitos act as vectors for the disease. The first outbreak was found in Thailand in 1958. After that, it spread out to various provinces with densely populated large cities. Public transportation also facilitated the spread of dengue to all provinces nationwide (Department of Disease Control, Ministry of Public Health, 2002) during a time of global outbreak of the disease. In 2011 the number of patients increased in many countries, with estimates of approximately 50 million people infected annually. Thailand is classified as a country with a risk of disease caused by climate change especially diseases caused by mosquitoes.

When the world has a higher temperature, blood-eating mosquitoes lay eggs and bite more frequently (World Health Organization, 2011).

Dengue fever outbreak situation reports in Thailand dating back 5 years from 2014 to 2018 found numbers of patients were 25408, 18521, 21414, 33937 and 14193 per hundred thousand population respectively with the deaths of 43, 29, 17, 21 and 13 respectively. The mortality rate was 0.13, 0.16, 0.08, 0.06 and 0.09, respectively. In patients who died in 2018, 70% were adults.

The main causes of dengue fever are from many factors. For instance, lack of efficiency in the elimination of the adult mosquitoes with chemicals, or environmental changes such as higher temperature which directly affect the rate of dengue by shortening the life cycle of mosquitoes that grow from eggs to adult mosquitoes. In addition, social factors such as lifestyle, community cooperation, population density and the behavior of people in the community will affect the outbreak of dengue fever. Effective prevention and control of dengue fever should focus on prevention of disease in advance by community efforts to control the breeding of mosquitoes in houses, communities and important places, especially in educational institutions and hospitals which should have a mosquito larvae index equal to zero. In the past, it was found that disease control by public health agency such as fogging for mosquito elimination and conducting a survey of mosquito larvae according to each house in a community still cannot prevent and control the disease effectively. The main problem results in lack of cooperation from the community. Some groups of people do not allow officials to conduct surveys of larvae.

Although dengue is a community problem because of Lack of awareness, dengue fever becomes a community problem, community responses are often limited and there are not having not enough public health officers to survey and to get rid of mosquitoes as well as the limitations of the community. For example, some groups are not at home because of going out to pursue a career so officials cannot access homes, together with the workload pressure of the relevant official staff. Therefore, it may be is important to survey the mosquito larvae index and will go to explore when there is an outbreak of dengue fever in the area only. As the data from the community leader of Buak Had Community, Phra Sing Sub-district, Mueang District, Chiang Mai Province, demonstrates, causing the control of the breeding of mosquitoes in the areas of delays and ineffective measures, has been limited. The government should therefore encourage people to participate in disease prevention and control in order to suit the area and the environment of each community, leading to positive change. People in the community are aware of the problem and see the importance of participation by turning to co-operating to help control and prevent disease in their own homes continuously and sustainably.

In Chiang Mai, dengue patients were found in every district of Chiang Mai, where which each district has a variety of areas. Therefore, the researchers were interested in exploring the dengue fever situation by exploring ecological environmental factors and mosquito-borne disease factors by mosquito larvae index evaluation. Assessments of the situation of dengue fever of in Baan San Din Daeng, Mae Pon Sub-district, Chom Thong District, Baan Mae Ha, Baan Pong Sub-district, Hang Dong District and Buak Had Community, Phra Sing Sub-district, Mueang District, Chiang Mai Province, were made, and to use the information obtained was used to develop a dengue fever prevention and control model in Chiang Mai Province, by using Montfort College as the research base.

Research Objectives;

1. To study the situation of dengue fever of Baan San Din Daeng Village, Chom Thong District, Baan Mae Ha Village, Hang Dong District and Buak Had Community, Mueang District, Chiang Mai Province.

2. To explore ecological and environmental factors of mosquito-borne disease factors

3. To calculate the mosquito larvae index.

4. To analyze the information and interpret the results of the study. To study the relationship between dengue fever and the ecological and environmental factors, and to be able to use as guideline for prevention and control model of dengue fever by using Montfort College School as the base.

Research Questions

1. Do the differences of environment in sub-district areas affect the situation of dengue fever?

2. Do the different ecological factors affect the mosquito larvae index?

3. What is the mosquito larvae index of each study site?

Research Hypothesis

1. The differences of environment in sub-district areas affect the dengue fever problems.

2. Different ecological environmental factors affect the mosquito larvae index.

3. The mosquito larvae index of each study site is different.

Materials and methods of research

1. Determining the scope of study site

1.1 The Rural community: study site of Baan San Din Daeng Village, Mae Pon Sub-district, Chom Thong District, Chiang Mai Province.

(GPS location is 18.7830728”N, 98.9791551”E)

1.2 The semi-rural community: study site of Ban Mae Ha Village, Ban Pong Sub-district, Hang Dong District, Chiang Mai Province.

(GPS location is 18.7950434”N, 98.8349707”E)

1.3 The City community: study site of Buak Had Community, Phra Sing Sub-district, Mueang District, Chiang Mai Province.

(GPS location is 18.7830728”N, 98.9791551”E)

2. Materials and Equipment used in the field

2.1 Principles of conducting studies on mosquitoes / manual for determining the study site of mosquitoes in the field.

2.2 Household data collection form, survey pattern for mosquito larvae index.

2.3 Tools for storing mosquito larvae in the study site, namely, torch, colander, larvae scoop, clear plastic bags and rubber band, taxonomy classification of mosquito larvae type, guideline for GPS field study method, data record form of study methodology GPS, permanent marker, microscopes and pencils / pens. Tools to measure the physical data of containers with water, namely the litmus paper and thermometer for measuring the temperature. According to information from the Mosquito Habitat Mapper application.

2.4 Tools for detecting mosquito larvae by reference to the classification of mosquito larvae, namely, microscope, beaker, dropper, and slide.

3. Research methodology

This research is a survey research. Survey data is collected by searching data. Use the household data collection model and the prevalence survey of mosquito larvae by studying and researching concepts, theories and related research results as guidelines in education by proceeding in the following order:

3.1 Search for the situation of Chiang Mai's Dengue Fever from Bureau of Vector Borne Diseases, the Department of Disease Control.

3.2 Determination of study site. The researchers randomly selected the 98 houses by divided as follow: 38 houses in Baan San Din Daeng Village, Baan Pon Sub-district, Chom Thong District, 40 houses in Baan Mae Ha Village, Baan Pong Sub-district, Hang Dong District and 20 houses in Buak Had Community, Phra Sing Sub-district, Mueang District, Chiang Mai Province. Collect communities' characteristics and collect samples of mosquito larvae in the area of rural community, semi-rural community and city community respectively.

4. Data collection methods

Collect data between November 2018 to January 2019 by collaboration with hospitals and district public health officers to collect data on the dengue fever situation and the mosquito larvae.

5. Surveying, collecting and identifying mosquito larvae samples

Collect mosquito larvae in the community from the water containers around the house in a radius of 15 meters, with the goal being a Aedes mosquito larva (Aedes aegypti). In this study, the research was conducted in accordance with the principle of the mosquito operations of the GLOBE project (using GLOBE protocols), which conducted a survey of every container with water around the house by using a flashlight to check the mosquito larvae while water was still, to observe the movement of mosquito larvae. When the mosquito larvae are found in the container, scoop all the mosquito larvae in the container with a colander. Put the mosquito larvae into the plastic bag with a little water in the bag and tie the bag with the rubber band. Write the container code on a plastic bag using a permanent marker and write the container code in the record form. Put mosquito larvae into the laboratory by using a microscope and taxonomy to classify mosquito larvae, record data in a data record form and uploading to GLOBE website.

6. Analysis, Discussion and Conclusion of research results

6.1 Analyze data using frequency distribution, percentage and mean.

6.2 Analysis of mosquito larvae index values by various values. There are Larvae index formula as follows:

House Index (HI) The Percentage of houses showed mosquito larvae

$$HI = \frac{\text{The number of houses surveyed showed mosquito larvae}}{\text{Total number of houses surveyed}} \times 100$$

Container Index (CI) The Percentage of containers showed mosquito larvae

$$CI = \frac{\text{The number of container surveyed showed mosquito larvae}}{\text{Total number of container surveyed}} \times 100$$

6.3 Identification of risk from the mosquito larvae index

In identifying the risk level of dengue fever by using the abundance index of that mosquito larvae. The Ministry of Public Health has set the criteria for the risk of dengue fever (Usawadee Thawara, 2010) as follows:

Mosquito Larvae Index	Criteria			
	Very high risk of disease spread	High risk of disease spread	Low risk of disease spread	Safe for dengue fever
House Index (HI)	>50	50 - 10	< 10	0
Container Index (CI)	>10	10 - 5	< 5	0

The Study Result:

The study results show 2 parts of data which are as following

Part 1 Dengue Hemorrhagic Fever Situation in Chom Thong District, Hang Dong District and Mueang District Chiang Mai Province.

Part 2 Data from the ecological environment exploration and Aedes Aegypti larvae index at Baan San Din Daeng Village, Mae Pon Sub-district, Chom Thong District, Baan Mae Ha Village, Baan Pong District and Buak Had Community, Phra Sing Sub-district, Mueang District, Chiang Mai Province.

Part 1 Dengue Hemorrhagic Fever Situation in Chom Thong District, Hang Dong District and Mueang District Chiang Mai Province.

Table 1: Dengue Hemorrhagic Fever Disease Situation (Bureau of Communicable Diseases, led by insects, Department of Disease Control)

District	Number of Population (people)	Number of patients (people)	Sickness Rate per Hundred Thousand population (Percentage)	Mortality Rate (people)	Fatality Rate (percentage)
Chom Thong District	66,507	0	0.00	0	0.00
Hang Dong District	83,888	1	1.19	0	0.00
Mueang District	104,391	4	3.83	0	0.00

From Table 1 showing the data of Dengue Hemorrhagic Fever Situation in Chom Thong District, Hang Dong District and Mueang District, it was found that there were 4 patients in Mueang District (3.83 Sick Rate per hundred thousand population), there was 1 patient in Hang Dong District (1.19 Sick Rate per hundred thousand population) and no patients in Chom Thong District (Dengue Situation Report, Chiang Mai Province Public Health Office; Cumulative data from November 2018 to January, 2019).

Part 2 Data from the ecological environment exploration and Aedes Aegypti larvae index at Baan San Din Daeng Village, Mae Pon Sub-district, Chom Thong District, Baan Mae Ha Village, Baan Pong District and Buak Had Community, Phra Sing Sub-district, Mueang District, Chiang Mai Province.

Table 2: The number and percentage of communities classified by house styles and construction materials

House styles and construction materials	Baan San Din Daeng Village		Baan Mae Ha Village		Buak Had Community	
	Number of Households	Percentage	Number of Households	Percentage	Number of Households	Percentage
Types of Community						
● City Community	-	-	-	-	232	100.00
● Semi-Rural community	-	-	40	100.00	-	-
● Rural Community	38	100	-	-	-	-
Houses Distribution						
● Single House	5	13.16	10	25.00	109	46.98
● 1-5 Households	33	86.84	23	57.50	72	31.03
● More than 5 Households	-	-	7	17.50	51	21.98
House Styles						
● A Single Storey House Leaving high empty space under the house	27	71.05	5	12.50	5	2.16
● A Single Storey House leaving low empty space under the house	10	26.32	7	17.50	2	0.86
● A Single Storey House	-	-	22	55.00	85	36.64
● A Two-Storey House	1	2.63	6	15.00	94	40.52
● Shop House	-	-	-	-	46	19.83
Construction Materials						
● Wood	37	97.37	15	37.50	14	6.03
● Cement and Wood	1	2.63	17	42.50	79	34.05
● Cement	-	-	8	20.00	139	59.91
● Etc.	-	-	-	-	-	-
The house has garbage and waste containers that are breeding places for mosquitoes	-	-	11	29.7	15	6.47
Area and Environment Characteristics	Mountain range with streams flowing through		Foothills with Frogs/Fish pond		The plains with swamps in parks and moats	

From Table 2, we found that the community type of Baan San Din Daeng Village was all rural area. The houses' distributions were 86.84 percent of 1-5 households and 13.16 percent of single house. For the house styles, there were 71.05 percent of a single storey house leaving high empty space under the house, 26.32 percent of a single storey house leaving low empty space under the house and 2.63 percent of a two-storey house.

Classifying by construction materials, we found that 97.37 percent was made of wood and 2.63 percent was made of cement and wood. The area and environment characteristic was Mountain range with streams flowing through.

The community type of Baan Mae Ha Village was semi-rural community. The houses' distributions were 57.50 percent of 1-5 households, 25 percent of single house and 17.50 percent of more than 5 households. For the house styles, there were 55.00 percent of a single storey house, 17.50 percent of a single storey house leaving low empty space under the house, 15 percent of a two-storey house and 12.50 percent of a single storey house leaving high empty space under the house. Classifying by construction materials, we found that 42.50 percent was made of cement and wood, 37.50 percent was made of wood and 20 percent was made of cement. The area and environment characteristic was foothills with frogs and fish ponds

The community type of Buak Had Community was a city community. The houses' distributions were 46.98 percent of a single house, 31.03 percent of 1-5 households and 21.98 percent of more than 5 households. For the house styles, there were 40.52 percent of a two-storey house, 36.61 percent of a single storey house, 19.83 percent of shop house, 2.16 percent of a single storey house leaving high empty space under the house and 0.86 percent of a single storey house leaving low empty space under the house. Classifying by construction materials, we found that 59.91 percent was made of cement, 34.05 percent was made of cement and wood and 6.03 percent was made from wood. The area and environment characteristic was the plains with swamps in the parks and the moats

Table 3: Container types, surveyed containers and percentage of containers that found mosquito larvae

Container Types	Percentage of containers that found mosquito larvae								
	Baan San Din Daeng Village			Baan Mae Ha Village			Buak Had Community		
	No. of Inspected	No. of Larvae found	Percentage	No. of Inspected	No. of Larvae found	Percentage	No. of Inspected	No. of Larvae found	Percentage
Inside									
Water tank in the bathroom	30	0	0.00	3	1	33.33	-	-	-
The back of the refrigerator	-	-	-	3	1	33.33	-	-	-
In the kitchen	5	0	0.00	1	0	0.00	-	-	-
Cooking pot	2	0	0.00	1	0	0.00	-	-	-
Outside									
Water Jar	24	0	0.00	18	2	11.11	13	3	23.08
Plastic bucket	7	0	0.00	25	4	16.00	67	14	20.90
Vase	-	-	-	8	0	0.00	8	5	62.50
Water container for pets	10	0	0.00	10	2	20.00	11	3	27.27
Saucer	-	-	-	15	1	6.67	9	2	22.22
Aquatic plant container	-	-	-	15	6	40.00	29	11	37.93
Tire	-	-	-	3	2	66.67	8	1	12.50
Tree sheath	2	0	0.00	5	2	40.00	32	15	46.88
Amount	**80**	**0**	**0**	**107**	**21**	**19.63**	**177**	**54**	**30.51**

Table 3: Water-holding containers was one component of the ecology of the mosquito that showed the relationship of mosquitoes with the habitats. Baan San Din Daeng Village found 80 containers with water but did not see any mosquito larvae, Ban Mae Ha Village found 21 pieces of container with mosquito larvae from all surveyed 107 pieces of container. The water-holding containers inside the house which were found the most are at the back of the refrigerator and the water tank in the bathroom and the least found in the kitchen and the pot with water storage inside. For the water-holding containers outside the house the most were found at the tires and the least were found at the saucers. Buak Had Community was found 54 pieces of container with mosquito larvae from all surveyed 177 pieces of container. From the water storage containers outside the house the most were found at the vases for the shrine of the household god and the least were found at the tires and the plastic bucket respectively.

Table 4: Average temperature and pH value of water reservoir classified by type of reservoirs

Container Types	Baan San Din Daeng Village			Baan Mae Ha Village			Buak Had Community		
	No. of Inspected	Water Temperature (degree Celsius)	pH Value	No. of Inspected	Water Temperature (degree Celsius)	pH Value	No. of Inspected	Water Temperature (degree Celsius)	pH Value
Inside									
Water tank in the bathroom	30	20	6	3	22	7	-	-	-
The back of the refrigerator	-	-	-	3	25	7	-	-	-
In the kitchen	5	21	7	1	21	6	-	-	-
Cooking pot	2	20	6	1	23	7	-	-	-
Outside									
Water jar	24	21	6	18	23	6	13	21	6
Plastic bucket	7	21	6	25	24	7	67	25	6
Vase	-	-	-	8	25	7	8	24.5	7
Water container for pets	10	20	7	10	25	7	11	25	6
Saucer	-	-	-	15	24	6	9	25	6
Aquatic plant container	-	-	-	15	23	6	29	24	7
Tire	-	-	-	3	25	7	8	26	6
Tree sheath	2	20	7	5	24	7	32	25	7
Amount	**80**			**107**			**177**		
Average		**20.4**	**6.4**		**23.7**	**6.7**		**24.4**	**6.4**

Table 4: The average of the temperature and pH value of water storage container were classified by types of the water storage containers. It was found that there were 80 pieces of water container at Baan San Din Daeng Village where the average temperature was 20.4 degree Celsius and pH value average was 6.4. While Baan Mae Ha Village, there were 107 pieces of water container found where the average temperature was 23.7 degree Celsius and pH value average was 6.7. At Buak Had Community, there were 177 pieces of water container found where the average temperature was 24.4 degree Celsius and pH value average was 6.4.

Table 5: Prevalence index of mosquito larvae classified by villages

Name of Community	Number of houses			HI	Number of containers		CI
	Total	No. of Inspected	No. of Larvae found		No. of Inspected	No. of Larvae found	
Baan San Din Daeng	38	38	0	0	80	0	0
Baan Mae Ha	40	40	12	30.00	107	21	19.63
Buak Had Community	232	20	8	40.00	177	54	30.51

Table 5: Prevalence index of mosquito larvae classified by villages. It was found that in Baan San Din Daeng Village, the house index value (HI) was 0 and the container index (CI) value was 0. In Baan Mae Ha Village, the house index value (HI) was 30.00 and the container index (CI) value was 19.63. At Buak Had Community, the house index value (HI) was 40.00 and the container index (CI) value was 30.51.

Conclusions, discussion and suggestions

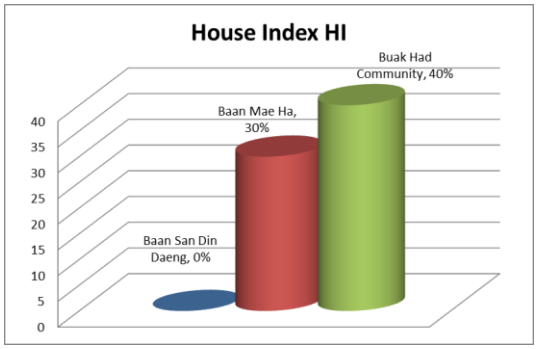
1. The results of the survey showed that the differences in the area of the communities have an effect on the situation of dengue fever. The characteristics of the communities in which the study site of the three communities took place effect different distribution characteristics. Taking the example of the rural community characteristics of a group of 1-5 houses, most of the houses are single-story houses, elevated under the basement. Semi-rural communities have distribution characteristics of homes 1-5 houses, mostly single-storey houses, and in city communities, the distribution of houses is single houses, of which most are two-storey houses. Different city to rural population densities result in the creation of more containers of water trapped within the city community. Exploration of some houses was limited by the type of person in the dwelling, for example a person with limited time or mobility who could not assist with exploration. Some houses have dogs, so exploration can only safely take place outside the house. In rural communities both the leader and villagers were found to be aware of dengue fever problems and cooperated with the research team as well. For example, the villagers took the researcher to survey in the area of rural community. The semi-rural community leaders and villagers were also aware of dengue fever problem and cooperated with the research team. There were officials from the Ministry of Education surveying larvae and campaigning on Big Cleaning Day with villagers regularly, but some people needed to go to work, or go to study in the city so these people did not have time to clean up the water sources

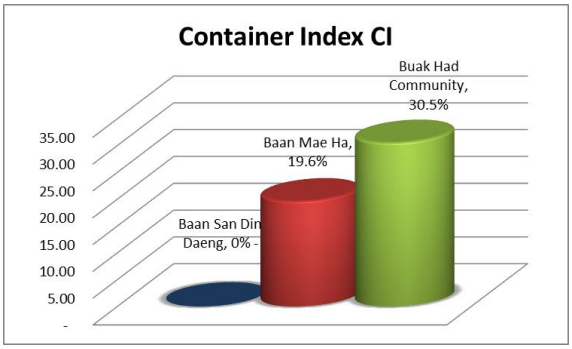
around the house. Additionally, while some houses were inhabited, the survey team could not explore because they could not get cooperation with some people worrying that they would be criminals, or elderly people or housekeeper not allowing the researcher to do the survey at the house. Finally, with the workload of the relevant officials staff might focus on other works so they did not focus on the mosquito larvae index.

2. The results of the survey showed that different ecological environmental factors had an effect on the mosquito larvae index. It was found that the container which contains lots of Aedes aegypti larvae (the semi-rural community) is a man-made containers, such as water tanks in the bathroom and plastic water tanks. But no Aedes aegypti larvae were found in the rural communities due to the different lifestyles. The city community will have to decorate the house, making the containers more water-retaining than rural communities and have different ways of life. People in the city will go to work outside the home, so there is no time to clean the house or get rid of containers, sources of water that cause mosquito larvae. As can be seen from the mosquito larvae index, the Aedes aegypti larvae is not found in the rural community. While semi-rural and rural communities have HI and CI values In high risk criteria. It can be seen that the differences in the area of the community and the environmental factors on ecological differences affect the mosquito larvae index. In accordance with the research of Usawadee Thawara (2010: 8) that found that the number of mosquito larvae found in each area is significantly different when between different areas. But the information is slightly different from winter to summer.

In terms of average temperature and pH values of water in the water reservoir classified by type of water-confinement sources, it was found that the pH value did not differ significantly between 6.4-6.7. Therefore, it should not be a factor that affects the change of the mosquito larvae index In accordance with the research of Supawan Phrompera and Chree Kai Kaew (2014 : 49), it was found that the relationship between mosquitoes and temperature and pH values were low and insignificant.

3. The mosquito larvae index of all three study site is different. Ban San Din Dang Village, house Index (HI) value was 0 and the container index (CI) value was 0 which were safe for Dengue fever, Baan Mae Ha Village house Index (HI) value was 30.0% and the container index (CI) value was 19.6% which showed the high risk of disease spread and Buak Had communities, the house Index (HI) value was 40.0% and the container index (CI) value was 30.51% which showed the high risk of disease spread.





Suggestions and what should be added to make the research more complete.

The group has used the information that has been planned, developed and tested for use as a guideline for prevention and control of dengue fever as follows:

Activities		The Operation Period
Plan	1. Establish volunteer groups and student leaders	February 2019 - April 2019
Do	2. Provide knowledge and guidelines for volunteer groups, student leader and general students.	February 2019 – May 2019
	3. Explore and eliminate breeding sites for mosquito larvae at school and at home every other 7 days and notify each other to the points that found mosquito larvae or problem areas.	May 2019 - March 2020
Check	4. Additional activities such as releasing fish in the basin, giving away the abet sand for students to go home, arrange public relations boards.	May 2019 - arch 2020
	5. Student leaders meeting with teachers	May 2019 - March 2020
Action	6. Review and improve the guidelines for activities.	October 2019 and April 2020

Suggestion for next project

1. Should study and cover all seasons to find out seasonal changes affecting the number of mosquito larvae in the study site
2. Should extend the study site and number of houses and to cover more areas in Chiang Mai province. Because some sub-districts in the city can control the dengue fever very well
3. There should be a study of all types of mosquito larvae that are found.
4. There should be a study of the different ways of living and people's behavior affecting dengue fever in different areas of Chiang Mai

5. Applying knowledge obtained from studies on the life cycle of mosquito larvae to be used for control or use chemicals that are not harmful to the environment and can be decomposed completely after use.

GLOBE Badges

Collaboration

This researchers had received support from villagers in all 3 communities, Public health volunteers in areas that guided them to each area for the survey. As well as providing information on the households in the community. Public health officers in each district who are educators and taught the techniques in exploring mosquito larvae. Entomologists from The Office of Disease Prevention and Control No.1 Chiang Mai Province, Department of Disease Control, Ministry of Public Health, Thailand provided knowledge on the classification of mosquito larvae and adult mosquitoes. Dr. Wannapa Suwankerd, advisor scientist research, Teacher Noppawan Metheechutikul and other teachers, advisors and coordinators of research projects, supportive parents. And last but not the least, the three researchers who have passion, patience and determination in this study.

Data scientist

The researchers studied history data and the situation of dengue hemorrhagic fever in Chiang Mai province by searching and collecting data from the Department of Disease Control and study the 3 different study sites to find the relationship between situations Dengue fever considering the ecological and environmental factors. And discussion of the results to answer research questions by assuming hypothesis for guideline of research.

Make an impact

The results of the survey of all 3 study areas showed that there were different characteristics and behaviors of most people regarding perception, intention to solve problems and collaboration of people in the community. The strength of awareness and collaboration among people in rural communities which the research group have applied the guidelines or prevention model to the semi-rural community and city communities by creating awareness, preventing and controlling mosquito larvae focusing on educating students using the school as a base and extend to the student's family, in their communities and worldwide as well.

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