Comparative Study of Mosquito Larvae Species in the Vicinity of Varee Chiang Mai School, Mueang District, Chiang Mai

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Preface

A Comparative Study of Mosquito Larvae Species in the Vicinity of Varee Chiangmai School, Mueang District, Chiang Mai : A Survey Research

This research, conducted in the form of a survey, comparatively examines mosquito larvae species in the vicinity of Varee Chiangmai School, Mueang District, Chiang Mai. The study aims to categorize mosquito larvae found in both artificial containers and natural breeding sites to identify vector species with the potential to transmit diseases. Furthermore, it investigates the influence of water temperature and pH levels on larval development, acknowledging that mosquito-borne diseases pose a significant public health challenge globally, particularly in tropical and subtropical regions.

Currently, climate change is exacerbating this issue by accelerating the development of mosquito larvae into adult vectors, increasing their feeding frequency, oviposition rates, and flight range. Consequently, the incidence of mosquito-borne diseases is escalating. Despite advancements in research, technology, and mosquito control strategies, this persistent problem necessitates continuous monitoring and proactive measures to mitigate the risk of resurgent outbreaks.

This comparative survey will contribute to a deeper understanding of the effects of water temperature and pH on mosquito larvae proliferation in both artificial and natural breeding habitats within the school's surrounding environment. Specifically, the research will establish a baseline dataset for developing effective mosquito larvae elimination strategies, which will be utilized to inform public health campaigns within the school and adjacent communities.

The findings will also be disseminated to interested parties, empowering them to apply this knowledge for practical benefit in their daily lives.

Research Title: Comparative Study of Mosquito Larvae Species in the Vicinity of varee Chiang Mai School, Mueang District, Chiang Mai

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Abstract

This research aimed to investigate and compare mosquito larvae species at Varee Chiangmai School, Mueang District, Chiang Mai, and disseminate the findings within the school and local community. The study area was defined within Varee Chiangmai School, specifically focusing on the workshop area and the overgrown vegetation near the school. In studying the mosquito larvae species, Mosquito larvae samples were collected weekly, every Friday, for a period of five weeks, starting from January 17, 2025, and ending on February 14, 2025. The collected larvae were carefully placed in prepared containers for further analysis. Studying Mosquito Larvae Species: The collected mosquito larvae were examined using a stereomicroscope to identify their characteristics. The larvae were placed in a petri dish with a small amount of water to facilitate observation under the microscope. The identified characteristics of the mosquito larvae were recorded using GLOBE Mosquito Habitat Mapper. Additionally, Studying Water pH and Temperature in the Survey Area. To studying water pH using a Universal Indicator: Water samples were collected from three different points within the study area. A universal indicator was used to determine the pH of the water samples. The universal indicator was immersed in each water sample, and the resulting color was compared to the pH scale to determine the pH level. The results were recorded for further analysis and to study water temperature in the survey area: Water temperature measurements were taken at the same three points where water

samples were collected for pH analysis. A thermometer was used to measure the water temperature. To avoid direct hand contact affecting the temperature readings, a string was attached to the thermometer for immersion and retrieval. The thermometer was immersed in the water at each point, and the temperature readings were recorded. The research revealed as follows: 1) Water pH: The average pH of water in the workshop area was found to be 6.4, indicating a slightly acidic condition. The average pH of water in the overgrown vegetation was 6.7, also slightly acidic but less acidic than the workshop area. 2) Water Temperature: The average water temperature in the workshop area was 23.68 degrees Celsius. The average water temperature in the overgrown vegetation was 22.68 degrees Celsius. 3) Mosquito Larvae Species: A total of 81 mosquito larvae were found in the workshop area, comprising: 32 Aedes Aegypti larvae (39.5%), 15 Anopheles larvae (18.5%), 22 Culex larvae (27.2%), and 12 Mansonia larvae (14.8%). A total of 82 mosquito larvae were found in the overgrown vegetation, comprising: 16 Aedes Aegypti larvae (19.5%), 36 Anopheles larvae (43.9%), 9 Culex larvae (11%), and 21 Mansonia larvae (25.6%). These findings indicate that the water temperature in the overgrown vegetation was lower than in the workshop area, resulting in different dominant mosquito larvae species. This suggests that environmental conditions influence the breeding of different mosquito larvae species, supporting the research hypothesis that higher water temperatures correlate with a decrease in mosquito larvae populations, depending on the study area.

Keywords: GLOBE Observer: Mosquito Habitat Mapper, Water Temperature, Water pH, Mosquito Larvae, Thailand

Acknowledgement

This project was successfully completed with the gracious support of Ms. Varee Patravanich, the Director of Varee Chiang Mai School, for her support and facilitation in providing equipment and research facilities throughout the research period. We would like to express our sincere gratitude to Ms. Titthayaporn Kaewpingmuang, Ms. Kingkanok Yodwiset, Ms. Kritsana Ounanta, and Mr. Accadech Chaimoolthan, the project advisors, for their consultation and guidance on conducting the research project to a successful completion. We would like to express our earnest gratitude to Ms. Krittiya Utara-in, the science laboratory supervisor, for her assistance in preparing the materials and equipment for testing the pH and temperature of the water, which are factors in mosquito larvae breeding. We extend our appreciation to Ms. Aphantree Suharuetaya for her information consultation on the research project. We would like to convey our heartfelt thanks to the parents for their support and encouragement to the students to work on the research until the completion of the project.

Finally, we wish to express our sincere gratitude to the authors of the academic documents from books, journals, various websites, as well as the research data of all those whose information we have cited in this research. This project would not have been possible without the generous contributions of numerous individuals and institutions. We are deeply grateful for their support and guidance.

The research team

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Chapter 1

Introduction

Background and Rationale

Mosquitoes are small insects that have a significant impact on human lives due to their role in transmitting various diseases, posing a threat to people's health. These diseases include dengue fever, malaria, and Zika. Mosquito-borne diseases are a major public health concern in many countries worldwide, particularly in tropical and subtropical regions. These diseases not only affect public health systems but also cause economic damage to many countries that have to find ways to manage disease outbreaks. Each country has sought to prevent and treat mosquito-borne illnesses. Despite the development of new research and technologies in mosquito control, this issue remains a matter of concern and importance. In Thailand, one of the critical issues that the Ministry of Public Health focuses on is the problem of re-emerging infectious diseases (REID), such as dengue fever and malaria, which are transmitted by mosquitoes. The Ministry of Public Health has been continuously seeking methods to prevent and monitor these diseases. Currently, climate change has caused mosquito larvae to develop into adult mosquitoes more quickly, feed more frequently, lay eggs sooner, and fly farther. This has increased the likelihood of mosquito-borne diseases occurring more rapidly and frequently.

Varee Chiangmai School, located in Mueang District, Chiang Mai, has a workshop with numerous materials and equipment that can accumulate water, creating breeding grounds for mosquito larvae. Additionally, sunlight cannot reach the area all the time, and there are small organisms such as microorganisms that can serve as food sources for mosquito larvae, helping them grow well. The school is also adjacent to natural breeding grounds with large, overgrown trees and an environment with stagnant water that is not adequately maintained, allowing mosquito larvae to thrive. A comparative study of mosquito larvae species is a survey of mosquito larvae species to classify the types of mosquito larvae that will grow into disease-carrying vectors in both man-made and natural breeding grounds. The study also examines water temperature and pH levels, which affect

mosquito larvae breeding. This survey study will contribute to the knowledge and understanding of water temperature and pH levels that affect mosquito larvae breeding at Varee Chiangmai School, Chiang Mai Province. The basic information obtained will be used to develop effective guidelines for eliminating mosquito larvae breeding grounds and for public awareness campaigns in schools and nearby communities. The information can also be disseminated to interested individuals to apply this knowledge for the benefit of their daily lives.

Research Questions

1. How does water temperature affect mosquito larvae breeding?
2. Does the study area affect the species of mosquito larvae found at Varee Chiangmai School?

Research Hypotheses

1. Mosquito larvae breeding will decrease as water temperature increases.
2. The study area affects the growth of mosquito larvae.

To be specific, if the water temperature increases, the number of mosquito larvae will decrease, depending on the study area.

Research Objectives

1. To study and compare the species of mosquito larvae at Varee Chiangmai School, Mueang District, Chiang Mai.
2. To disseminate the study's findings within the school and community.

Expected Outputs

1. Data on water temperature and pH levels that affect mosquito larvae breeding at Varee Chiangmai School, Chiang Mai.

2. A better understanding of water temperature and pH levels and their impact on mosquito larvae breeding at Varee Chiangmai School, Chiang Mai.

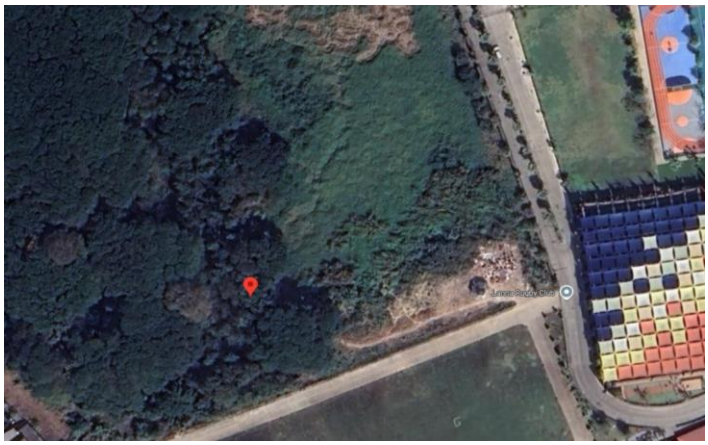
3. The baseline data obtained from this study will be used to eliminate mosquito larvae and prevent their breeding, as well as to disseminate the acquired knowledge to the school and surrounding communities.

Scope of Study

Study Area

Varee Chiangmai School, 59 Moo 6, Mahidol Road, Nong Hoi Subdistrict, Mueang Chiang Mai District, Chiang Mai 50000, located at latitude 18.75859 °N and longitude 99.0154074

- Study Area 1: The workshop area, located at latitude 18.75663°N and longitude 99.01499°E.



- Study Area 2: The overgrown vegetation adjacent to Siriwatthananiwet Health Park, located at latitude 18.75716°N and longitude 99.01350°E.

Factors to be Studied and Measured

- Species of mosquito larvae
- Water temperature
- pH level in the water

Research Period

- January 2025 - February 2025

Chapter 2

Literature Review and Related Research

This research project, "Comparative Study of Mosquito Larvae Species in the Vicinity of Varee Chiang Mai School, Mueang District, Chiang Mai" involved a review of relevant theoretical literature and research, as detailed below:

2.1 Mosquitoes

2.2 Species of Mosquito Larvae

2.3 Mosquito Life Cycle

2.4 Breeding Grounds

2.5 Mosquito-borne Diseases

2.6 pH of water

2.7 Stereo microscope

2.8 Globe Mosquito Habitat Mapper

2.9 Related Research

2.1 Mosquitoes

Mosquitoes are insects found worldwide, but they are most prevalent in tropical and subtropical regions. Mosquito larvae typically feed on bacteria, protozoa, yeast, algae, and small aquatic plants. Female mosquitoes feed on nectar and blood, while males usually feed on flower nectar. Mosquitoes are also vectors for various diseases, such as dengue fever. There are approximately 3,450 species of mosquitoes worldwide, with about 412 species found in Thailand. The most familiar species are the Anopheles and Aedes mosquitoes.

Globally, there are over 4,000 species of mosquitoes, classified under the order Diptera and Culicida family. Some mosquito species are vectors for diseases affecting humans and animals. For example, the *Aedes aegypti* and *Aedes albopictus* mosquitoes

transmit dengue hemorrhagic fever. *Culex tritaeniorhynchus* mosquitoes transmit Japanese encephalitis, while *Anopheles* mosquitoes transmit malaria. *Mansonia* mosquitoes transmit filariasis or elephantiasis. These diseases occur in humans, but mosquitoes are also significant vectors for various animal diseases. For instance, *Culex quinquefasciatus* mosquitoes transmit heartworm in dogs and avian malaria. Some mosquito species also bite cattle, leading to weight loss and reduced milk production. In addition to the dangers they pose to humans and warm-blooded animals, mosquitoes are also harmful to cold-blooded animals.

Figure 1: Physical Characteristics of a Mosquito

2.2 Species of Mosquito Larvae

Mosquito larvae exhibit distinct morphological and behavioral characteristics that allow for species identification. These characteristics include the presence and structure of the breathing tube (siphon), body position in relation to the water's surface, and movement patterns.

- **Anopheles larvae:** These larvae lack a breathing tube and lie parallel to the water surface. Their movement is characterized by a side-to-side, S-shaped motion.
- **Mansonia larvae:** These larvae possess a short, saw-toothed breathing tube that pierces the roots of aquatic plants. They attach at a 45-degree angle to the water surface and exhibit an S-shaped movement.

- **Culex larvae:** These larvae have a long, slender breathing tube and position themselves at a 45-degree angle to the water surface. Their movement is also S-shaped.

- **Aedes larvae:** Aedes larvae are characterized by a short, stout breathing tube (siphon) and position themselves at a 45-degree angle to the water surface. Their movement is described as a "jerky" or "whiplike" motion. *Aedes aegypti* larvae can be differentiated from *Aedes albopictus* larvae by the number of ventral brushes. *Aedes aegypti* possesses 5 pairs of ventral brushes, while *Aedes albopictus* has only 4 pairs.

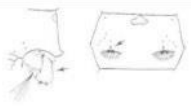
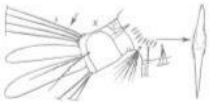
Anopheles larvae	Mansonia larvae	Culex larvae	*Aedes aegypti*	*Aedes albopictus*
 	 	 	 	 
Findings	Findings	Findings	Findings	Findings
- Lack a breathing tube - Lie parallel to the water surface - Exhibit S-shaped motion	- Possess a short, saw-toothed breathing tube - Attach at a 45-degree angle to the water surface - Exhibit S-shaped movement	- Possess a long, slender breathing tube - Position themselves at a 45-degree angle to the water surface - Exhibit S-shaped movement	stout breathing tube - Position themselves at a 45-degree angle to the water surface - Possess "jerky" or "whiplike" motion - Possesses 5 pairs of ventral brushes	- Possess short, stout breathing tube - Position themselves at a 45-degree angle to the water surface - Possess "jerky" or "whiplike" motion - Possesses 4 pairs of ventral brushes

Table 1: Images and description of Mosquito Larvae Species

2.3 Mosquito Life Cycle

Mosquitoes undergo complete metamorphosis, a process involving four distinct stages: egg, larva, pupa, and adult. The characteristics of the eggs, larvae, pupae, and adults vary among different mosquito species. These differences are utilized for species identification in research and study.

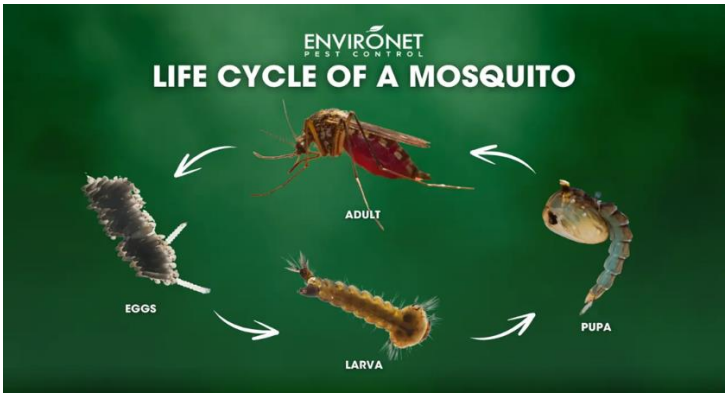


Figure 2: The Life Cycle of a Mosquito

2.4 Breeding Habitats

Different mosquito species exhibit preferences for specific breeding habitats. These preferences are related to water quality, the presence of vegetation, and other environmental factors.

- Anopheles larvae: These larvae typically breed in slow-moving, relatively clean water sources such as rock pools, tree hollows, and rice paddies. They are often found in areas distant from urban centers, such as in forested foothills.
- Mansonia larvae: These larvae primarily breed in stagnant water bodies with abundant aquatic vegetation, such as ponds containing water hyacinths, duckweed, or other aquatic plants, as well as in swampy areas with such vegetation.
- Culex larvae: These larvae prefer stagnant water found in various locations, including puddles, rock pools, drainage pipes, stagnant water under houses, water in rice fields, animal footprints, and dirty water-holding containers.

- Aedes larvae: These larvae characteristically breed in clean water sources found around homes, such as water storage containers (e.g., jars, tanks, cement basins, and pots), discarded containers (e.g., cans, coconut shells, and tires), flower vases, and fruit peelings.

2.5 Mosquito-borne Diseases

Mosquitoes are vectors for a variety of diseases, some of which are detailed below:

- Malaria: The Anopheles mosquito is the vector for malaria. This disease is prevalent in forested areas, overgrown vegetation, hot and humid climates, and near various water sources. Symptoms include fever, headache, body aches, fatigue, rapid pulse, chills, nausea, vomiting, and pallor due to the destruction of red blood cells. Anemia may develop, leading to jaundice, and urine may be dark, resembling fish sauce in color.

- Filariasis (Elephantiasis): The Mansonia mosquito transmits filariasis. Symptoms include a sudden high fever, inflammation of the lymphatic vessels and lymph nodes, which may be observed in various areas such as the legs, lower abdomen, spermatic cord, or breasts. The affected skin will be swollen and red, with lymphatic fluid accumulation, and may feel lumpy. However, some individuals may not exhibit obvious swelling.

- Japanese Encephalitis: The Culex mosquito is the vector for Japanese encephalitis. This disease is often found in rice paddies due to them being mosquito breeding grounds, and pigs act as reservoirs for the disease. Culex mosquitoes transmit the disease from infected pigs to humans and other animals. Symptoms appear 5-15 days after infection and include high fever, vomiting, headache, and fatigue. Neurological symptoms then develop, such as stiff neck, decreased consciousness, lethargy, delirium, seizures, coma, tremors, or paralysis. Even after recovery, some neurological deficits may persist, such as slurred speech, spasms, or cognitive impairment.

- Dengue Fever: The Aedes mosquito transmits dengue fever. Symptoms appear 5-8 days after being bitten by an infected mosquito and include a sudden high fever, body aches, loss of appetite, and possible vomiting. A red rash may appear on the body, and

bleeding may occur easily, including black stools. Severe complications can arise, such as shock, seizures, edema, chest tightness, abdominal pain, or internal bleeding.

2.6 Water pH

Water pH is a measure of its acidity or alkalinity, ranging from 0 to 14. pH values indicate whether water is acidic, alkaline, or neutral:

- pH < 7: Acidic
- pH > 7: Alkaline (or basic)
- pH = 7: Neutral

Most natural water sources have a near-neutral pH, typically ranging from 6.5 to 8.5. Exceptions include water with dissolved carbon dioxide, which may have a pH below 5, and hard water containing dissolved carbonates, which may have a pH above 9.

pH influences chemical reactions and equilibria in water. Water treatment processes, such as chemical precipitation, water softening, and disinfection, often require pH control. Furthermore, very low pH can be corrosive and damage pipes and equipment.

2.7 Stereo microscope

A stereo microscope is a type of light microscope specifically designed to produce three-dimensional images. It provides clear depth of field, giving a view similar to that of the naked eye at a magnified scale.

The three-dimensional image is created by paired objective lenses, positioned parallel to each other and slightly offset, mimicking the binocular vision of human eyes. When viewed through the eyepieces, the two images merge, creating a virtual 3D image. Auxiliary objective lenses can be added to further increase magnification.

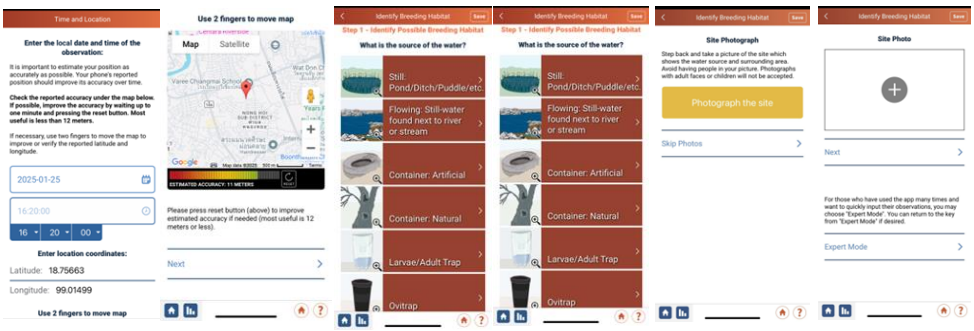
Stereo microscopes typically offer low to medium magnification (approximately 5-100x), making them suitable for viewing opaque objects. They are commonly used in industrial applications for examining and observing surface details of objects such as circuit boards, amulets, diamonds, insects, flowers, etc. The 3D view provides a realistic perspective, revealing texture, structure, and size of very small objects.

Figure 3: Stereo microscope

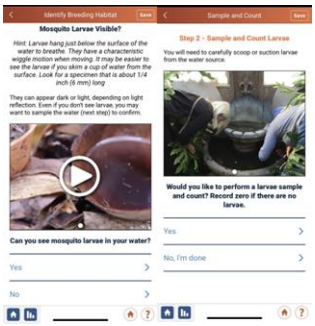
2.8 The GLOBE Mosquito Habitat Mapper App

Figure 4: GLOBE Mosquito Habitat Mapper Application

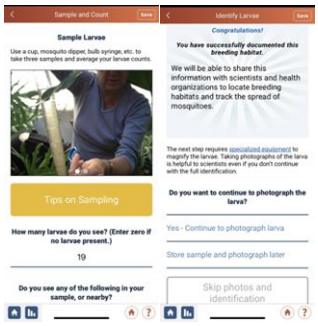
The GLOBE Mosquito Habitat Mapper (MHM) app, a NASA-sponsored initiative, contributes to the mitigation of mosquito-borne diseases, including dengue, Zika, and malaria. The MHM app pursues the goals of increased public awareness and decreased disease risk through three primary avenues: (1) the collection and analysis of scientific data on mosquito habitats; (2) the empowerment of individuals to actively reduce local mosquito populations by eliminating standing water sources; and (3) the education of younger generations and citizen scientists regarding the breeding sites of Aedes aegypti and Aedes albopictus, the primary vectors for dengue and Zika viruses.



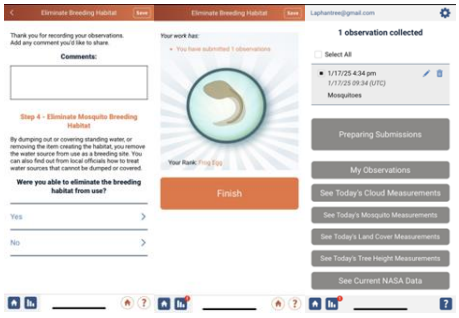
Step 1 Identify Potential Mosquito Habitats



Step 2 Sample and Count



Step 3 Identify Larva Type



Step 4 Eliminate

Figure 5: The GLOBE Mosquito Habitat Mapper App and its four steps

2.9 Related Research

1. A Comparative Study of Mosquito Larvae Species and Abundance in a Nakprang Rubber Plantation.

A comparative study of mosquito larvae species and abundance was conducted in a Nakprang rubber plantation in Bua Khok Pho Mak Khaeng Subdistrict, Bueng Khong Long District, Bueng Kan, Thailand. This survey research investigated mosquito larvae in double-crop fields, a rubber plantation, and agricultural plots. In February 2021, mosquito larvae were collected using standard collection methods and identified microscopically. The study identified Aedes and Culex (nuisance) mosquito larvae in the rubber plantation, and Anopheles and Culex larvae in the agricultural plots. A total of 26 larvae were collected: 46.15% were identified as Aedes aegypti, 30.76% as Anopheles species, and 23.07% as Culex species. The rubber plantation exhibited a slightly acidic pH of 6.0 and contained 8 larvae (6 Aedes aegypti and 2 Anopheles spp.). A second site within the rubber plantation had a pH of 5.66, also slightly acidic, and contained 8 larvae (6 Anopheles spp. and 2 Culex

spp.). The agricultural plots, with a pH of 4.66 (slightly acidic), also yielded 8 larvae (6 Aedes spp. and 2 Anopheles spp.). These findings suggest that rubber plantation workers are at risk of contracting dengue fever and malaria, while agricultural workers are at risk of malaria and Japanese encephalitis.

2. The Relationship between Mosquito Larvae Diversity and Abundance and Land Cover in Coastal Areas of Trang, Thailand.

This study investigated the influence of coastal land cover types on mosquito species diversity and abundance in Trang Province, Thailand. Ovitraps were deployed within four distinct land cover categories: beach forest, Melaleuca forest, mangrove forest, and forest near residential areas. Each land cover type was represented by a 10 x 50 square meter plot, within which 20 ovitraps were placed, totaling 80 ovitraps. Prior to water addition, ovitrap containers were filtered through a double layer of fine nylon mesh (0.5 mm intermesh gap) to remove existing macroinvertebrates. Mosquito larvae were collected from each ovitrap between January and February 2020 and identified to the genus and/or species level. Three mosquito larval types were identified: Ae. aegypti, Ae. albopictus, and Culex spp. Ae. aegypti and Ae. albopictus were most abundant in the mangrove forest (88.89% and 43.34%, respectively). Culex spp. were most abundant in the forest near residential areas (60%), which also exhibited the highest pupal abundance (42.99%). Ae. albopictus and total mosquito larvae abundance positively correlated with water temperature, electrical conductivity, and water volume. Culex spp. larvae abundance positively correlated with electrical conductivity. Aedes aegypti abundance was highest in mangrove and near-residential forests, while Ae. albopictus abundance was highest in mangrove forests. Culex larvae were most abundant in Melaleuca forests. The highest co-occurrence of Ae. aegypti and Ae. albopictus was observed in mangrove and near-residential forests (0.67% of positive containers). The highest co-occurrence of Ae. albopictus and Culex larvae was found in near-residential forests (5.34% of positive containers). Ae. aegypti and Culex larvae did not co-occur in any sampled area, nor did all three larval types co-occur. These results provide valuable information regarding mosquito vectors in coastal Trang Province, Thailand, including species diversity, distribution, and

factors associated with breeding habitat preference. This information is crucial for targeted surveillance and control strategies aimed at preventing the spread of mosquito-borne diseases to coastal communities. These findings contribute to the understanding of mosquito ecology and support the development of effective mosquito control strategies applicable to coastal areas of Thailand.

3. Mosquito Species and Container Types in the Vicinities of Sawatrattanapimuk School and Ban Nong Sai School, Trang, Thailand.

This study compared mosquito larvae abundance and species composition between Sawatrattanapimuk School and Ban Nong Sai School, Na Yong District, Trang Province, Thailand. Larval samples were collected four times weekly at each school over a two-week period during March and April. Identified larvae at Sawatrattanapimuk School were predominantly Culex (87.5%), with Aedes albopictus comprising the remaining 12.5%. At Ban Nong Sai School, Aedes albopictus was the dominant species (87.5%), followed by Culex (12.5%). Common larval habitats at both schools included discarded tires, pools, potted plants, ditches, ponds, and water tanks. These results indicate the presence of similar mosquito larval species at both locations, although their relative abundances differed.

Chapter 3

Research Methodology

This research project employed a comparative survey methodology to investigate mosquito larvae species. The study comprised the following sequential methods:

1. Formulate research questions
2. Define the Study Area for Mosquito Larvae
3. Study Water pH and Temperature in the Survey Area
4. Collect Mosquito Larvae
5. Study Mosquito Larvae Species
6. Record the results on GLOBE Mosquito Habitat Mapper

The research process was conducted in the following sections:

3.1 Research Plan

This research is a survey-based study.

3.2 Equipment and Materials

3.2.1 Beaker	3.2.2 Bucket
3.2.3 Dropper	3.2.4 Inoculation needle
3.2.5 Petri dish	3.2.6 Spoon
3.2.7 Stereo microscope	3.2.8 Thermometer
3.2.9 Universal indicator	

3.3 Methodology

3.3.1 Collection of Mosquito Larvae for Study and Investigation of Mosquito Larvae Species.

Part 1: Defining the Study Area for Mosquito Larvae:

1.1 Prepare equipment for collecting mosquito larvae samples.

1.2 Survey the environment within the school vicinity.

1.3 Define study points: the workshop area and the overgrown vegetation area near the school.

1.4 Mosquito larvae were collected and placed in prepared containers every Friday for five weeks, commencing on January 17, 2025, and concluding on February 14, 2025.

Part 2: Studying Mosquito Larvae Species:

2.1 Prepare equipment for studying mosquito larvae characteristics: stereomicroscope, petri dish, beaker, inoculation needle and dropper.

2.2 Place mosquito larvae in the petri dish and add a small amount of water.

2.3 Place the petri dish onto the stage plate of the stereo microscope.

2.4 Study the characteristics of the mosquito larvae.

2.5 Record the results on GLOBE Mosquito Habitat Mapper

3.3.2 Studying Water pH and Temperature in the Survey Area

Part 1: Studying Water pH using a Universal Indicator:

1.1 Prepare the universal indicator for studying water pH.

1.2 Immerse the universal indicator in water at three different points.

1.3 Compare the universal indicator with the pH scale and record the results.

Part 2: Studying Water Temperature in the Survey Area:

2.1 Prepare a thermometer and tie a string to it to avoid direct hand contact.

2.2 Hold the string and immerse the thermometer in the water at three different points.

2.3 Record the results.

Chapter 4

Research Results

This study examined mosquito larvae species and measured water pH and temperature in the designated survey areas. The findings are detailed below:

4.1 Water pH in the survey areas

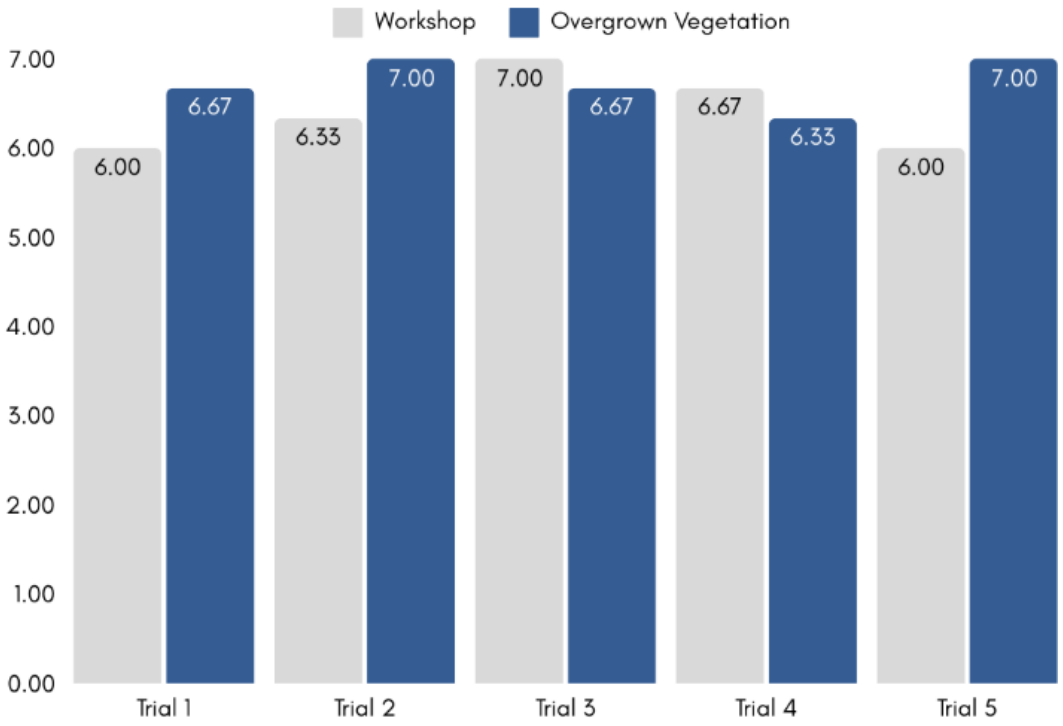


Figure 6: presents the average water pH values obtained using a universal indicator for each location.

The data in the figure above presents that the average pH value in the workshop area was 6.4, classified as slightly acidic. The average pH value in the overgrown vegetation was 6.7, classified as neutral. Notably, the workshop area exhibited a higher acidity level than the overgrown vegetation.

4.2 Water temperature in the survey areas

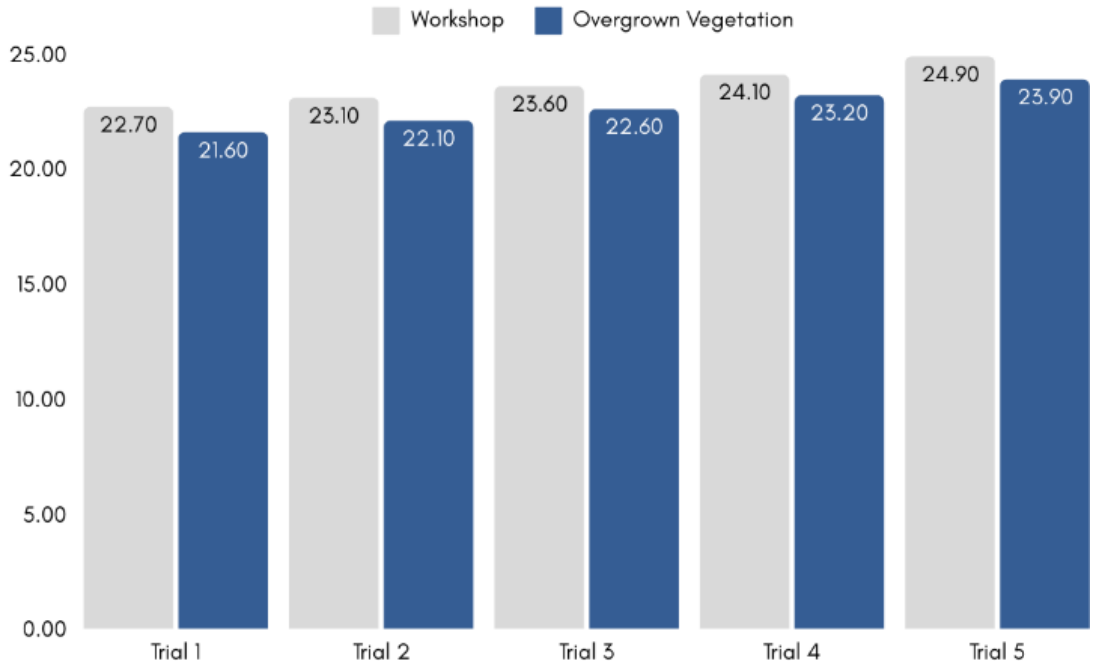


Figure 7: presents the average water temperature in the Survey Areas

The data in the figure above presents that the average water temperature in the workshop area was 23.68 degrees Celsius, while the average water temperature in the overgrown vegetation was 22.68 degrees Celsius.

4.3 Mosquito larvae species in the survey areas

Mosquito Larvae Species	Workshop	Overgrown Vegetation
Aedes	32 (39.5%)	16 (19.5%)
Anopheles	15 (18.5%)	36 (43.9%)
Culex	22 (27.2%)	9 (11%)
Mansonia	12 (14.8%)	21 (25.6%)
Total Larvae	81	82

Table 2: the number of mosquito larvae species found.

The data in the table above indicate that a total of 81 mosquito larvae were found in the workshop area, comprising 32 *Aedes* larvae (39.5%), 15 *Anopheles* larvae (18.5%), 22 *Culex* larvae (27.2%), and 12 *Mansonia* larvae (14.8%). In the overgrown vegetation, a total of 82 larvae were found, consisting of 16 *Aedes* larvae (19.5%), 36 *Anopheles* larvae (43.9%), 9 *Culex* larvae (11%), and 21 *Mansonia* larvae (25.6%).

4.4 The comparison of pH and water temperature in the survey areas

The data obtained from measuring water pH and water temperature, along with the mosquito larvae species survey, are compared and presented in the following figure.

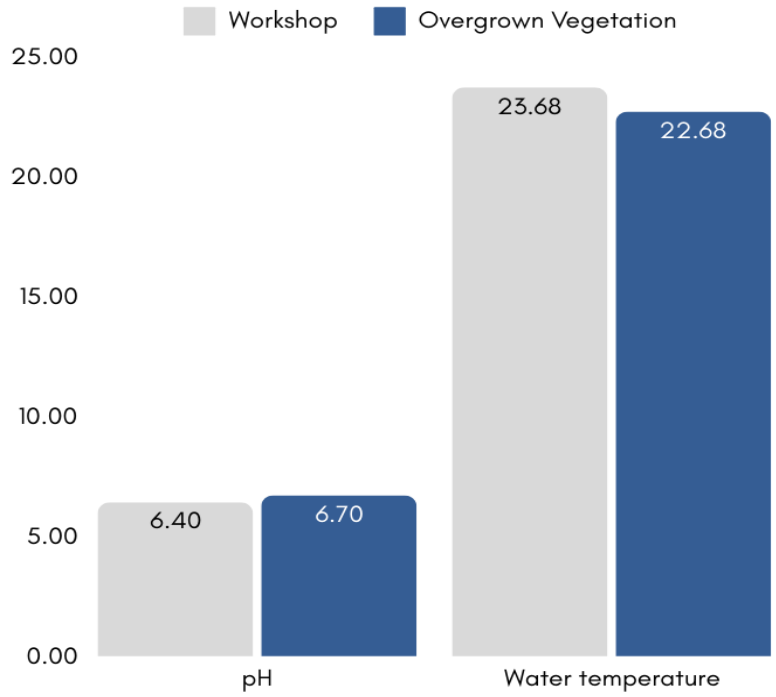


Figure 8: depicting the comparison of the average water pH and temperature in the Survey Areas

The mosquito larvae survey revealed that the average pH value in the workshop area was 6.4, classified as slightly acidic. The average pH value in the overgrown vegetation was 6.7, classified as neutral. Notably, the workshop area exhibited a higher acidity level than the overgrown vegetation and the average water temperature in the workshop area was 23.68 degrees Celsius, while the average water temperature in the overgrown vegetation was 22.68 degrees Celsius.

Chapter 5
Discussion, Conclusions and Recommendations

This study investigated mosquito larvae species, water pH, and water temperature in a specific survey area. The following summarizes the research findings and provides recommendations for future research.

5.1 Discussion and Conclusions

This study aimed to compare mosquito larvae species and disseminate the findings within the school and local community. The research focused on several factors related to mosquito larvae development, including larvae species, water temperature, and water pH within the school's workshop area and a nearby overgrown vegetation. The research revealed the following:

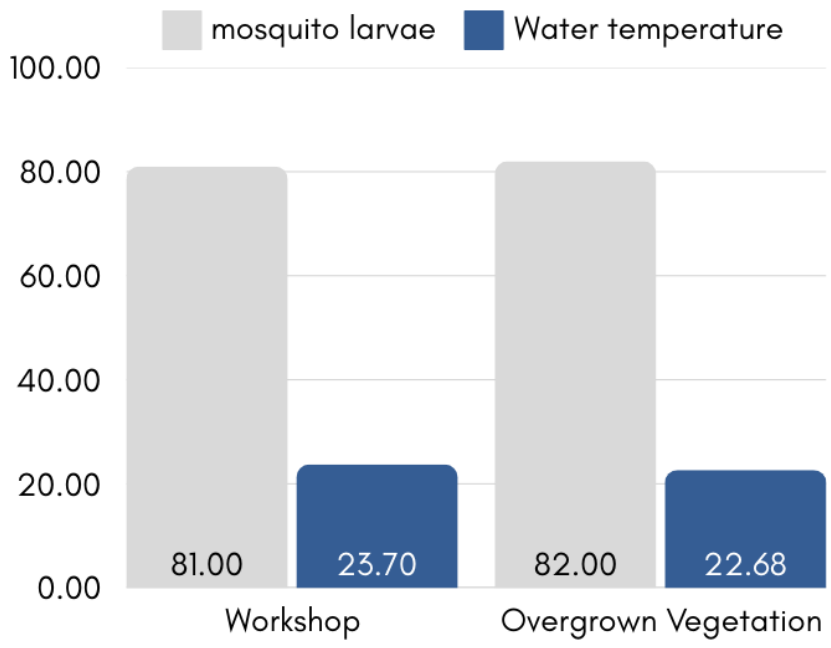


Figure 9: The comparison of water pH and temperature with mosquito larvae in the survey areas

The study revealed that the water temperature in the workshop area was 23.68 degrees Celsius, with a total of 81 mosquito larvae. The most prevalent species was Aedes aegypti larvae, accounting for 39.5% of the total. In the overgrown vegetation, the water

temperature was 22.68 degrees Celsius, with a total of 82 larvae. The most prevalent species in this area was Anopheles larvae, comprising 43.9% of the total. These findings indicate that the water temperature in the overgrown vegetation was lower than in the workshop area, resulting in different dominant mosquito larvae species. This suggests that environmental conditions influence the breeding of different mosquito larvae species, supporting the research hypothesis that higher water temperatures correlate with a decrease in mosquito larvae populations, depending on the study area.

5.2 Recommendations

Based on the findings of this study on mosquito larvae breeding, the following recommendations are made for future research:

1. Future studies should investigate mosquito larvae breeding across different seasons.
2. Researchers should collect data on various containers that facilitate mosquito larvae breeding.
3. The findings of this research should be integrated into classroom instruction and disseminated to interested individuals within the community.

We would like to earn these IVSS badges

1. I AM A DATA SCIENTIST

The report provides a detailed analysis of both the students' data and additional data sources. Students carefully consider how to interpret the data, examining connections between different sets of information and drawing meaningful conclusions. They use this data to answer specific questions or solve problems within the process they are studying. This process may include combining data from other educational institutions or using external databases to enhance their analysis. The geographical coordinates, including latitude and longitude, of the locations where mosquito larvae were observed and were recorded using the GLOBE Observer: Mosquito Habitat Mapper (MHM), ensuring accurate mapping for further study.

2. I MAKE AN IMPACT

The research explains the connection between a local community issue and research questions. Students show how their research has helped the community, such as by offering recommendations or taking action based on their findings. Studying the ecology of mosquito larvae helps us understand how mosquito larvae breed in order to reduce spread of diseases which is crucial for reducing the spread of diseases carried by mosquitoes.

3. I AM A PROBLEM SOLVER

The students learn that they can be part of possible solutions to the problems they are investigating. The study of mosquito larvae provides valuable insights into the complex interactions within the Earth's systems, highlighting the importance of an integrated approach to environmental science.

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Appendix

The tables below present the water pH values obtained using a universal indicator for each location.

Location	Trial 1					Trial 2					Trial 3				
	1	2	3	Mean	Acidity/ Basicity	1	2	3	Mean	Acidity/ Basicity	1	2	3	Mean	Acidity/ Basicity
Workshop	6	6	6	6	Slightly Acidic	7	6	6	6.33	Slightly Acidic	7	7	7	7	Neutral
Overgrown Vegetation	7	6	7	6.67	Slightly Acidic	7	7	7	7	Neutral	6	7	7	6.67	Slightly Acidic

Location	Trial 4					Trial 5				
	1	2	3	Mean	Acidity/ Basicity	1	2	3	Mean	Acidity/ Basicity
Workshop	7	7	6	6.67	Slightly Acidic	6	6	6	6	Slightly Acidic
Overgrown Vegetation	7	6	6	6.33	Slightly Acidic	7	7	7	7	Neutral

The tables below present the water temperature measurements obtained in the survey areas.

Location	Trial 1				Trial 2				Trial 3			
	1	**2**	**3**	**Mean**	**1**	**2**	**3**	**Mean**	**1**	**2**	**3**	**Mean**
Workshop	22.6	22.8	22.7	22.7	22.8	23.4	23.2	23.1	23.6	23.8	23.4	23.6
Overgrown Vegetation	21.6	21.9	21.5	21.6	21.9	22.2	22.1	22.1	22.7	22.9	22.4	22.6

Location	Trial 4				Trial 5			
	1	2	3	Mean	1	2	3	Mean
Workshop	23.9	24.1	24.2	24.1	24.9	24.8	25.2	24.9
Overgrown Vegetation	23.5	23.1	23.2	23.2	23.7	23.9	24.1	23.9

The table below presents the number of mosquito larvae species found.

Mosquito larvae species	Trial 1		Trial 2		Trial 3		Trial 4		Trial 5	
	Workshop	Overgrown Vegetation	Workshop	Overgrown Vegetation	Workshop	Overgrown Vegetation	Workshop	Overgrown Vegetation	Workshop	Overgrown Vegetation
Aedes	8	4	6	5	7	3	5	2	6	2
Anopheles	4	9	2	5	3	8	2	6	4	8
Culex	4	2	3	2	5	1	6	3	4	1
Mansonia	2	4	1	3	4	5	2	5	3	4
Total	18	19	12	15	19	17	15	16	17	15