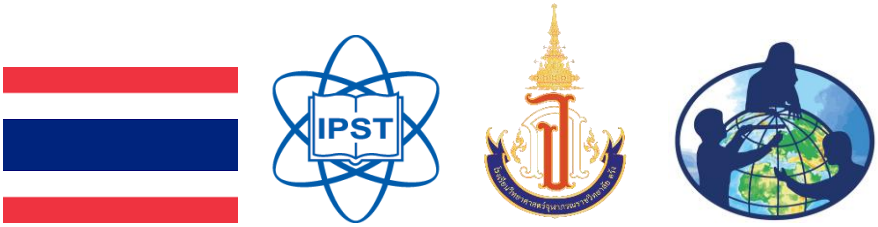

Study on the effects of water pH on survival rate, life cycle and size of Culex mosquitoes

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Abstract

This research aimed to know the survival rate of mosquito larva and pupa and the life cycle of Culex mosquitoes, including the size of larvae, pupa and Culex mosquitoes when raised in water with a pH value of 4-9. The results from the study of water pH values affecting the survival rate, life cycle and life of Culex mosquitoes found that different pH values had a statistically significant effect on the survival rate at .05. Larvae could not survive at pH 4, but could survive in pH 9 for the longest number of days, pH 8, 7, 6 and 5, respectively. pupa could survive in pH 8 and 9 the longest and survive in pH 5 the least. Mosquitoes could survive in pH 7 and 8 the longest and survive in pH 5 the least. The life cycle of Culex mosquitoes was found to be significantly different at different pHs at .05. The longest life cycle of Culex mosquitoes was found at pH 9 and. When studying the size of mosquitoes, it was found that they were statistically significant different at .05. The adult stage of mosquitoes had the least value at pH 5, while pH 8 and 9 had the most values. It was also found that the Culex mosquito can survive in water with different pH values. From the experimental results, it can be seen that when the pH value of the water in mosquito breeding grounds changes slightly, it can affect the life cycle of the Culex mosquitoes.

Keywords: Culex mosquito, larva, pupa, mosquito life cycle

Introduction

The spread of encephalitis, a contagious disease caused by the Japanese encephalitis (JE) virus, is a group of flaviviruses and is in the same group as dengue virus. The JE virus has the same properties as other flaviviruses, which are viruses that are transmitted by blood-feeding insects. In Asia, there are approximately 30,000-50,000 patients with this disease per year, including in Thailand.

This disease is transmitted by the Culex mosquito as an important vector. The mosquito is an insect that lives in various environments around the world, especially in warm tropical and subtropical regions. It is an animal that has completed four stages of metamorphosis: egg, larva, pupa and adult. The mosquito lays brown, elongated eggs, often in a raft floating on the edge above the water level. The mosquito also spends most of its life in water. This mosquito breeds in rice fields with stagnant water, drains, or even other containers that have been left with stagnant water. However, currently, air pollution, which may be caused by industrial plants, heavy traffic, and burning waste that releases pollutants mixed with rainwater into the air, are major causes of increased acid rain (Saraburi Provincial Fisheries Office, 2021). Wastewater from the rubber industry, which is common in the South, are all factors that change the pH of water in mosquito breeding grounds. Changing the pH of the water affects the spread of mosquitoes that are carriers of an important disease, namely encephalitis. Therefore, the research team is interested in studying whether changing the pH of water in mosquito breeding grounds affects the spread of mosquitoes that cause encephalitis. Using data to analyze the impact of pH changes on the potential for disease transmission and raise awareness in communities about understanding and finding additional preventive measures.

Research Questions:

1. Are there differences in the survival rates of larva of Culex mosquitoes and pupa when reared in water with pH values of 4-9?

2. Are there differences in the life cycle duration of Culex mosquitoes at different stages when reared in water with pH values of 4-9?

3. Are there differences in the size of Culex mosquitoes when reared in water with pH values of 4-9?

Objectives:

1. To study the survival rate of mosquito larvae and the survival rate of pupa when raised in water with pH 4-9

2. To study the life cycle of Culex mosquitoes when raised in water with pH 4-9

3. To study the size of Culex mosquitoes when raised in water with pH 4-9

Materials:

1) Transparent box container for mosquito eggs, size 7.5 x 7.5 x 15 cm, 18 pieces

2) Mobile phone and macro lens attached to mobile phone

3) Distilled water

4) Lime

5) Acetic acid

6) Universal indicator

7) Dropper

8) Vernier Caliper

9) Beaker

Methods:

1) **Study site**

Using a mosquito habitat mapper in Globe observer to collect data on larva collection sites in Princess Chulabhorn Science High School, Trang, located in Bang Rak Sub-district, Mueang District, Trang Province (coordinates 7.5595°N 99.6114°E).

Use land cover in Globe observer appplication to collect data in the area.

2) **Mosquito larva preparation step**

Collect 90 larvae of the second stage of the nuisance mosquito and 90 larvae of the third stage of the nuisance mosquito.

3) **Collect larva of the Culex mosquito**

Prepare containers for the larvae of the Culex mosquito using 18 clear glass boxes, size 7.5 x 7.5 x 15 cm, divided into 6 experimental sets: pH 4, 5, 6, 7, 8, 9, respectively, 3 containers per experimental set, and add 300 cubic centimeters of tap water that has been left in each container and adjust the pH value of the water to 4-9 using acetic acid and calcium carbonate. After that, add 5 larvae of the second stage of the nuisance mosquito and 5 larvae of the third stage of the nuisance mosquito into each container.

4) **Study the effect of pH value of water on the survival of larva, pupa and the duration of the life cycle of the Culex mosquito**

Place all containers in the same place to control temperature and humidity. Observe and record the changes of the nuisance mosquito larva every day. Record the number of days when larva transformed into larvae and adults and check the pH of the water daily if there is any change, maintain the pH.

5) **Data Analysis**

Use ANOVA test to analyze the effect of water at pH 4-9 on the survival rate of larva and larva of the Culex mosquito, the number of days for growth from larva to

pupa of the mosquito, the number of days for growth from larva to adults of the mosquito and the size of the mosquito.

Result

The project on the study of the pH value of water affecting the survival rate, life cycle and size of mosquitoes. The results of the study are as follows:

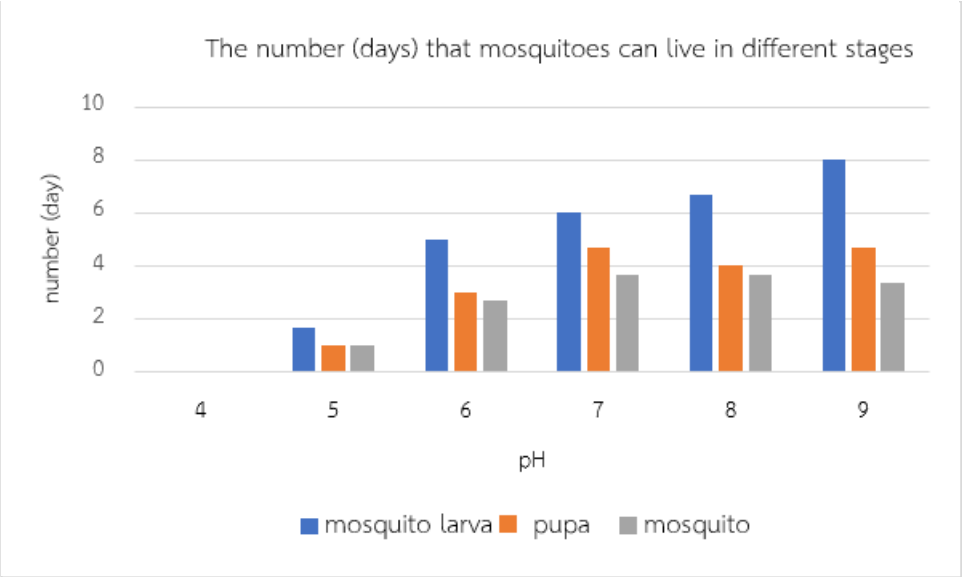
Part 1: Study of the survival rate of Culex mosquitoes in different stages at different pH

From the study of the survival rate of Culex mosquitoes in different stages, it was found that different pHs were significantly different at a statistical level of .05. The results of the study are as follows:

1. Larva can survive in pH 9 for the most days, pH 8, 7, 6, 5 respectively, but larva cannot survive in pH 4 at all.

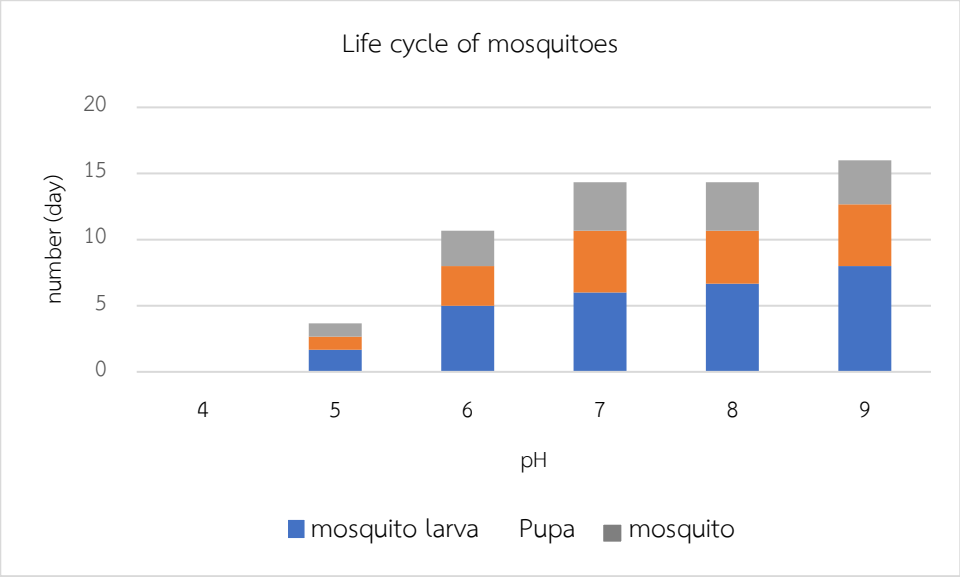
2. Pupa can survive in pH 8 and 9 for the longest time, but moths can survive in pH 5 for the least time.

3. Mosquitoes can survive in pH 7 and 8 for the longest time and mosquitoes can survive in pH 5 for the least time, as shown in the figure.



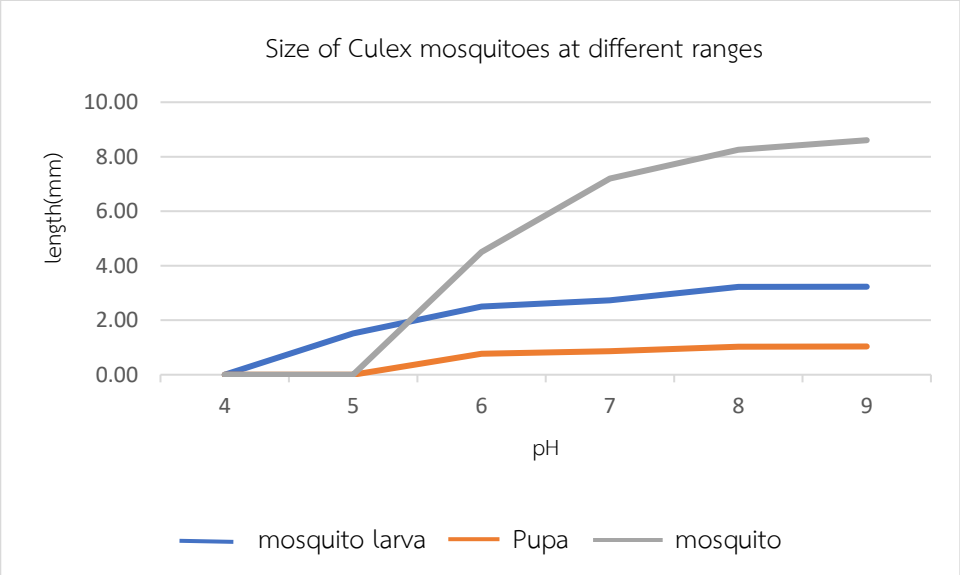
Part 2: Study of life cycle of Culex mosquitoes in different stages at different pH

From the study of life cycle of Culex mosquitoes, it was found that at different pH, there were cycles that were significantly different at .05. The mosquitoes had the longest cycle at pH 9 and could not survive at pH 4, as shown in the figure.



Part 3: Study of the size of Culex mosquitoes at different pH

From the study of the size of Culex mosquitoes at different pH, it was found that they were significantly different at .05, with the largest size of Culex mosquitoes at pH 9, as shown in the figure.



Discussion

The results of the study of the pH value of water affecting the survival rate, cycle and life of the Culex mosquitoes found that the difference in pH was significantly different at .05. Larva could survive in pH 9 for the longest period, pH 8, 7, 6 and 5 respectively. However, larva could not survive in pH 4 at all. Pupa could survive in pH 8 and 9 for the longest period, but pupa could survive in pH 5 for the shortest period. Mosquitoes could survive in pH 7 and 8 for the longest period, and mosquitoes could survive in pH 5 for the shortest period. The life cycle of the Culex mosquitoes found that the difference in pH was significantly different at .05. The longest life cycle of the mosquitoes was at pH 9 and could not survive at pH 4. When studying the size of the Culex mosquitoes, it was significantly different at .05. The Culex mosquitoes were the largest at pH 9.

From the experimental results, it can be concluded that pH 4 of acidic water, mosquito larva could not grow, and at pH 5, pH 6, pH 7, pH 8 and pH 9, mosquito larva can grow into pupa and adults. The longest life cycle of Culex mosquitoes is pH 8,9 and the shortest is pH 5, which is consistent with the work of Clark, Flis, & Remold, 2004, who stated that the influence of pH affects the decrease of the percentage of growth of larvae when changing to the pupa stage. And from the study of water pH and the size of adult mosquitoes, it was found that pH 5 has the lowest value, pH 8,9 has the closest value and is the highest. It was also found that Culex mosquitoes can survive in water with different pH values. And from the experimental

results, it can be seen that when the pH of the water in the mosquito breeding ground changes even slightly, it affects the life.

Acknowledgments

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GLOBE Data Entry

Land Cover

Measured Date:	2025-01-30
Organization Name:	Princess Chulabhorn Science High School Trang
Site ID:	56715
Site Name:	47NNJ615349
Latitude:	7.552809
Longitude:	99.557481
Elevation:	7.9m
Measured At:	2025-01-30T08:51:00
Measurement Latitude:	7.5534

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Appendix

Figure 1: shows the breeding area of the nuisance mosquito.

Figure 2: shows the breeding area of the nuisance mosquito.

Figure 3: shows the breeding area of the nuisance mosquito.

Figure 4: shows the breeding area of the nuisance mosquito.

Figure 5: shows the breeding area of the nuisance mosquito.

Figure 6: shows the larval stage of the Culex mosquitoes collected for use in the experiment.

Figure 7: shows the steps of making water at different pH values.

Figure 8: shows the experimental set.

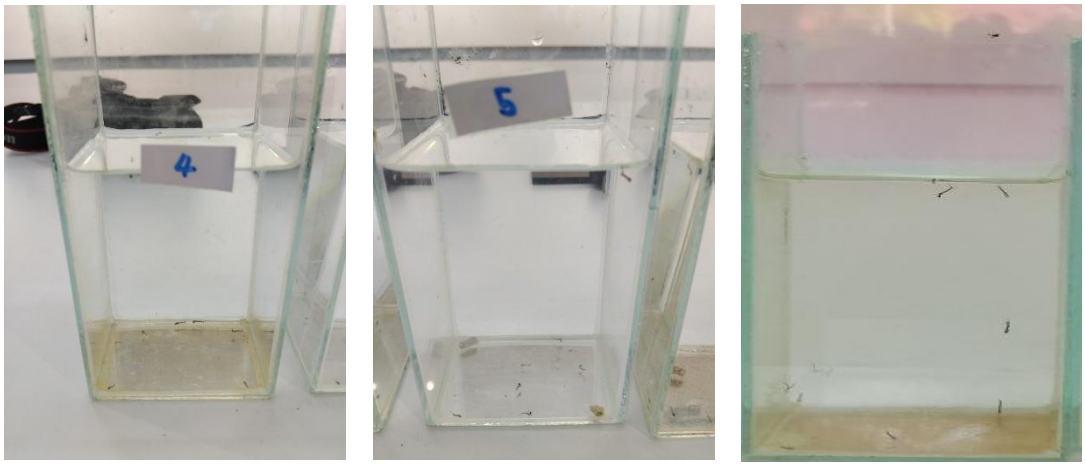

Figure 9 – 11: shows an experimental set in water with a pH value of 4 – 9.

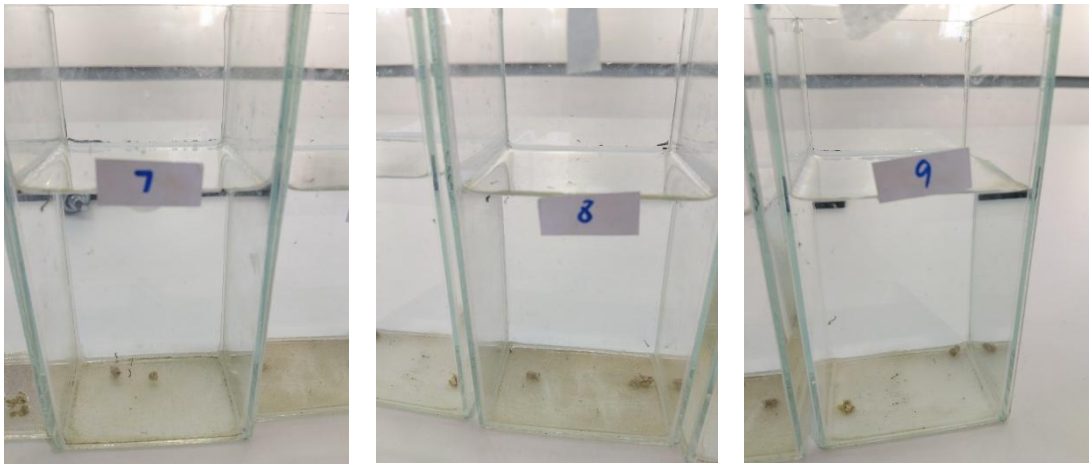

Figure 12 – 14: shows an experimental set in water with a pH value of 4 – 9.

Data science

The research began with careful mosquito observations in various environments. Researchers became intrigued by the different mosquito species and their unique characteristics. Through systematic data collection and monitoring of life cycles and water pH levels, they discovered that mosquito species have distinct abilities to survive in different environmental conditions and possess unique life cycles. The study emphasized the importance of structured, methodical research in understanding mosquito biology.

Problem solver

The research aims to provide community knowledge for addressing mosquito-related challenges. By studying water pH levels where mosquitoes develop (eggs, larvae, and pupae stages), the study offers insights into controlling nuisance mosquito populations and reducing the risk of Japanese encephalitis transmission.Understanding pH variations in mosquito habitats can help communities develop targeted strategies for mosquito population management and public health protection.

Collaborator

The research team worked together systematically, with each member assigned specific tasks such as monitoring pH levels, observing mosquito developmental stages, capturing research data, and compiling the final report. Their collaborative approach ensured a comprehensive and methodical investigation of mosquito development.