Research on the effects of plant essential oils on the mortality rates of mosquito larvae, taking into account social factors across different environmental conditions.

Kanwara Kaewthep Pattaraporn Kumpho Ponlapat Kunprayong Worramon Phonhom Sarussawadee Nooputtaya
Advisor :Professor Thapakorn kaewprom

The preparation team:Miss Kanwara Kaewthep Miss Pattaraporn Kumpho Master Ponlapat Kunprayong Miss Worramon Phonhom Miss Sarussawadee Nooputtaya
Grade level : Grade 8
Advisor :Professor Thapakorn Kaewprom
Dara academy Wat Ket Subdistrict, Mueang Chiang Mai District, Chiang Mai 50000, Thailand. Tel: 053-241-039

Research aims

1.To determine the most effective plants for assessing the percentage of mosquito larvae mortality within 24 hours by utilizing three different extracts at the same concentration.

2.To identify the optimal concentration, the most effective active extract was evaluated at three different concentration levels to ascertain the concentration that eliminates 90-100% of mosquito larvae.

3.To provide sustainable alternatives, develop a guide for the community on how to produce and utilize effective extracts.

ABSTACT

The objective of this research was to survey the distribution of mosquito larvae populations across five districts in Chiang Mai and to evaluate the effectiveness of natural extracts as eco-friendly mosquito control measures. Utilizing the GLOBE Observer: Mosquito Habitat Mapper protocol, a 10-week field survey was conducted in Mueang, Saraphi, San Sai (two sites), and Doi Saket districts. The results revealed that Mueang District exhibited the highest density of mosquito larvae (28 individuals), followed by Saraphi District (26) and San Sai District (23), respectively. Upon species classification, Annoying mosquito larvae (Culex spp.) were the most prevalent (49 individuals), followed by Aedes (38) and Anopheles (26). Population trends showed a significant surge starting from weeks 4–5, correlating with increased environmental humidity.

In the experimental phase, the mortality rates of mosquito larvae were compared after exposure to three botanical extracts: Lemongrass (Citronella), Neem, and Kaffir lime peel. The findings demonstrated that Lemongrass extract was the most effective, achieving a mortality rate of 86.6% (13 out of 15 individuals), significantly outperforming Neem extract (10 deaths) and Kaffir lime peel extract (9 deaths). The high efficacy of Lemongrass is attributed to its essential oil (Citronella oil), which disrupts the respiratory and nervous systems of the larvae. This research highlights the critical risk of mosquito-borne diseases in urbanized areas such as Mueang District and proposes Lemongrass extract as a sustainable alternative for community-based mosquito larval management.

Research questions

Which local herbal extract is the most effective at eliminating mosquito larvae??

Research scope

Research area : city , community , semi-rural community

- A.San Sai latitude18.8433490 longitude 99.0406711
- A.Saraphi latitude 18.6810914 longitude 98.9981658
-A.Doi Saket latitude 18.8022299 longitude 99.0744841
-A.Mueang latitude 18.8433490 longitude 99.0406711
- A.San Sai latitude 18.947871 longitude 98.981479

Factors that need to be studied and measured.

-Number of mosquitoes
-Mosquito activity index
-The pH level of water that contains mosquito larvae.

The duration in which I conducted the research

Data was gathered from October 2025 to February 2026.

Method of operation

Step 1: Research plants that can eliminate mosquitoes.
Step 2: Plan the experiment.
Step 3: Gather information on both the experiment itself and the verification process, including how to conduct the tests.
Step 4: Implementation – Conducting experiments.
Step 5: Application.
Step 6: Evaluating the results.

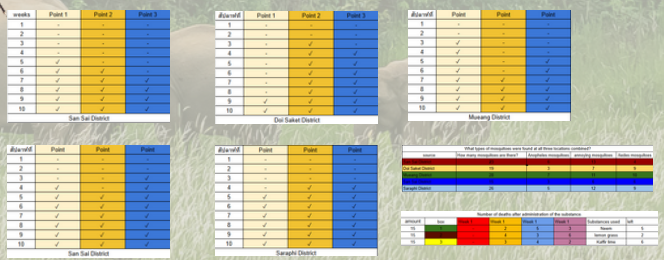
material

-Plants extract
-Soxhlet extractor
-Mosquito larvae
-Ethanol
-water

equipment

- Beaker
-Erlenmayer flask
- Spirit lamp
-Filter paper or cheesecloth
- Mosquito detection device

Research results



Summarize and discuss the experimental results.

1. Distribution and Types of Mosquitoes in the Study Areas From the 10-week survey, it was found that mosquitoes reproduced and spread in all surveyed districts. Mueang District had the highest mosquito population with 28 individuals, followed by Saraphi District (26 individuals), San Sai District (23 individuals), Doi Saket District (19 individuals), and the second site in San Sai District (15 individuals), respectively.Considering the overall mosquito species, annoying mosquitoes were the most commonly found in all areas, with a total of 49 individuals. This was followed by Aedes mosquitoes with 38 individuals, and Anopheles mosquitoes with 26 individuals.

2. Effectiveness of Natural Extracts in Mosquito Control Three types of extracts were tested: neem, lemongrass (citronella), and kaffir lime peel. Each test group contained 15 mosquitoes. The results showed that lemongrass extract had the highest effectiveness in killing mosquitoes, causing 13 deaths (only 2 survived). Neem extract caused 10 mosquito deaths, while kaffir lime peel extract caused 9 mosquito deaths Based on the results of this study, several important points can be discussed as follows:

1. Effects of Area and Time on Mosquito Occurrence From the 10-week data collection, it was found that in the early weeks (Weeks 1–2), very few mosquitoes were observed at many sites. However, mosquito populations increased significantly from Weeks 4–5 onwards in almost all areas. This may be explained by humidity and weather conditions during that period, which influenced the mosquito life cycle and egg hatching. In Mueang and Saraphi Districts, where mosquito populations were the highest, this may be due to physical environmental conditions such as standing water sources or water containers that provide suitable breeding sites.

2. Diversity of Mosquito Species The fact that annoying mosquitoes were the most commonly found species (49 individuals) suggests that the surveyed areas may contain water sources with high organic contamination, which are preferred breeding habitats for this species. Meanwhile, Aedes mosquitoes, found in the second-highest number (38 individuals), indicate a potential risk of dengue fever in the communities. This is especially concerning in Mueang District, where up to 10 Aedes mosquitoes were found, corresponding to urban areas with many household water containers.

3. Effectiveness of Natural Extracts The most significant finding is that lemongrass extract showed the highest mosquito-killing effectiveness from the second week onwards (with 4 mosquito deaths initially and increasing continuously). This can be discussed as being due to the presence of essential oils (citronella oil) in lemongrass, which strongly disrupt the mosquito nervous and respiratory systems more effectively than neem and kaffir lime peel at equal concentrations. Although neem is widely recognized for its insecticidal properties, this experiment showed that its action was slower than lemongrass extract during the initial period.

Reference documents

- GLOBE Program. (2024). Mosquito Habitat Mapper Protocol. [Online]. Available: . เอกสารอ้างอิง (The main document used to describe the procedure for surveying mosquito breeding grounds and classifying species using an application.)
- GLOBE Program. (2024). Water pH Protocol. [Online]. Available: เอกสารอ้างอิง (Reference document on methods for measuring the pH of water according to hydrological standards)
- The Hospital for Tropical Diseases, Faculty of Tropical Medicine, Mahidol University: The number of dengue fever cases in 2023 has surged! The death toll has reached 175. https://www.tropmedhospital.com/knowledge/54126.html
- The Pediatric Infectious Disease Society of Thailand issues a warning regarding the dengue fever outbreak and deaths in 2022. https://www.pidst.or.th/A1271.html
- phool how to use neem as a natural Mosquito Repellent? https://phool.co/blogs/homeessentials/how-to-use-neem-as-a-natural- mosquitorepellent.utm_medium=sangria&utm_source=sangria_blogs&utm_campaign=sangria_organic
- Record of the results of the mosquito population survey project in Chiang Mai Province. (2025). Survey data in 5 districts (San Sai, Doi Saket, Mueang, Saraphi) between weeks 1-10. (Researcher's data)
- Report on the efficacy testing of natural plant extracts. (2025). Comparative data on mosquito mortality rates between citronella, neem, and kaffir lime peel. (Researcher's data)
- The GLOBE Program. (2024). GLOBE Observer: Mosquito Habitat Mapper. Retrieved from 1. Distribution and Types of Mosquitoes in the Study Areas From the 10-week survey, it was found that mosquitoes reproduced and spread in all surveyed districts. Mueang District had the highest mosquito population with 28 individuals, followed by Saraphi District (26 individuals), San Sai District (23 individuals), Doi Saket District (19 individuals), and the second site in San Sai District (15 individuals), respectively.Considering the overall mosquito species, annoying mosquitoes were the most commonly found in all areas, with a total of 49 individuals. This was followed by Aedes mosquitoes with 38 individuals, and Anopheles mosquitoes with 26 individuals.
- 2. Effectiveness of Natural Extracts in Mosquito Control Three types of extracts were tested: neem, lemongrass (citronella), and kaffir lime peel. Each test group contained 15 mosquitoes. The results showed that lemongrass extract had the highest effectiveness in killing mosquitoes, causing 13 deaths (only 2 survived). Neem extract caused 10 mosquito deaths, while kaffir lime peel extract caused 9 mosquito deaths Based on the results of this study, several important points can be discussed as follows:
- 1. Effects of Area and Time on Mosquito Occurrence From the 10-week data collection, it was found that in the early weeks (Weeks 1–2), very few mosquitoes were observed at many sites. However, mosquito populations increased significantly from Weeks 4–5 onwards in almost all areas. This may be explained by humidity and weather conditions during that period, which influenced the mosquito life cycle and egg hatching. In Mueang and Saraphi Districts, where mosquito populations were the highest, this may be due to physical environmental conditions such as standing water sources or water containers that provide suitable breeding sites.
- 2. Diversity of Mosquito Species The fact that annoying mosquitoes were the most commonly found species (49 individuals) suggests that the surveyed areas may contain water sources with high organic contamination, which are preferred breeding habitats for this species. Meanwhile, Aedes mosquitoes, found in the second-highest number (38 individuals), indicate a potential risk of dengue fever in the communities. This is especially concerning in Mueang District, where up to 10 Aedes mosquitoes were found, corresponding to urban areas with many household water containers.
- 3. Effectiveness of Natural Extracts The most significant finding is that lemongrass extract showed the highest mosquito-killing effectiveness from the second week onwards (with 4 mosquito deaths initially and increasing continuously). This can be discussed as being due to the presence of essential oils (citronella oil) in lemongrass, which strongly disrupt the mosquito nervous and respiratory systems more effectively than neem and kaffir lime peel at equal concentrations. Although neem is widely recognized for its insecticidal properties, this experiment showed that its action was slower than lemongrass extract during the initial period.