Journal of Biotechnology and Natural Science
Vol. 5, No. 1, June 2025, pp. 11-20
ISSN 2808-2508

Preliminary Survey of *Aedes* sp. Larvae in Mosques of Banda Aceh During Ramadan 2025

Raudhah Putri Emil[1], Muhammad Farhan Putra Emil[2*]

[1]Study Program of Medicine, Faculty of Medicine, Malikussaleh University, North Aceh, Aceh, Indonesia
[2]Study Program of Animal Bioscience, Faculty of Agriculture, Teuku Umar University, West Aceh, Aceh, Indonesia
[1]raudhah.240610009@mhs.unimal.ac.id; [2]muhammadfarhan@utu.ac.id*
*corresponding author

ARTICLE INFO

Article history
Received: April 4th 2025
Revised: April 25th 2025
Accepted: April 30th 2025

Keywords
Aedes
Banda Aceh
Mosque
Preliminary Survey
Ramadan

ABSTRACT

The *Aedes* sp. mosquito is the main vector of dengue fever that breeds in environments with suitable breeding sites. Mosques, as places of worship with bathroom facilities and water storage containers, have the potential to become breeding grounds for *Aedes* sp. mosquitoes. This study aims to identify the presence of *Aedes* sp. larvae in mosque bathrooms in Banda Aceh during Ramadan 2025. A total of 45 mosques across nine districts were surveyed using a random sampling method (data representation with equal chances of selection). Observations focused on water storage containers, ventilation, lighting, and the availability of container covers. Larvae and water samples were collected and analyzed in the laboratory. The findings confirm the presence of *Aedes aegypti* and *Aedes albopictus* larvae, with a higher prevalence of *Aedes aegypti* due to its preference for indoor breeding sites. Poor ventilation, inadequate lighting, and uncovered water storage containers were key factors contributing to mosquito breeding. These results highlight the potential risk of dengue transmission in mosques, emphasizing the need for improved water management and preventive measures to ensure worshippers' safety. Strengthening mosquito control efforts in places of worship is essential to minimize dengue fever outbreaks, particularly during periods of increased human activity such as ramadan.

How to Cite: Emil, R.P. & Emil, M.F.P. (2025). Preliminary Survey of *Aedes* sp. Larvae in Mosques of Banda Aceh During Ramadan 2025. *Journal of Biotechnology and Natural Science*, 5(1):11-20.

1. Introduction

Aedes sp. mosquitoes, particularly *Aedes aegypti* and *Aedes albopictus*, are the primary vectors of dengue fever, a significant public health concern in tropical countries, including Indonesia (Zulfa et al., 2022). Previous studies have shown that *Aedes* sp. mosquitoes commonly breed in various types of water storage containers, both indoors and outdoors, including public places such as mosques, schools, parks, and government institutions (Agustina, 2018; Agustina and Kartini, 2019; Agustina et al., 2020; Dheandri et al., 2021; Agustina and Emil, 2024).

Places of worship, such as mosques, often contain water storage containers that may be overlooked in terms of cleanliness, making them potential breeding sites for *Aedes* sp. mosquitoes. Research conducted in Mijen District, Semarang City, confirmed the presence of *Aedes* sp. larvae in mosques, schools, parks, and government institutions, highlighting the risk of vector-borne disease transmission in public areas (Dheandri et al., 2021).

During the holy month of ramadan, mosques experience a significant increase in human activity, especially during *tarawih* prayers and other religious events. This heightened activity leads to increased water usage, making water storage containers in mosques more frequently replenished and thus more likely to serve as breeding grounds for *Aedes* sp. mosquitoes. Consequently, the risk of dengue transmission among worshippers may also rise during this period.

Banda Aceh, as the capital city of Aceh Province, has numerous mosques that serve as cental hubs for religious activities. Research on the presence of *Aedes* sp. larvae in mosques in Banda Aceh remains limited. However, a study conducted in three dengue-endemic districts in Banda Aceh revealed that out of 300 surveyed households, 158 were found to be positive for mosquito larvae, indicating a high risk of dengue transmission in the area (Yulidar, 2017). This study aims to identify the presence of *Aedes* sp. larvae in mosques across Banda Aceh during ramadan 2025. The findings of this study are expected to serve as a basis for dengue prevention and control efforts in places of worship, particularly during periods of increased activity such as ramadan.

This study holds particular significance considering the historical background of Banda Aceh, which suffered the most severe impact of the tsunami on December 26, 2004. This tragedy not only caused massive infrastructure damage but also significantly affected public health conditions (Agustina and Emil, 2024). Tsunami Aceh had an impact on public health (Gama and Agustina, 2022) by increasing outbreaks of infectious diseases (Rizky and Anggreni, 2020), such as those caused by mosquitoes. Therefore, investigating the presence of *Aedes* sp. larvae in mosques during ramadan 2025 is crucial to prevent potential dengue fever (DHF) outbreaks and ensure public health remains well-maintained.

2. Methods

2.1. Study Design

This study is an observational study with a descriptive approach conducted to identify the presence of *Aedes* sp. (Nurjanah et al., 2021). This observational study design was conducted by observing natural conditions without any manipulation or intervention on the subjects being studied. A descriptive approach was used to describe the phenomena occurring, in this case, the distribution and environmental conditions that support the presence of *Aedes* sp. larvae.

2.2. Time, Place, and Method

This study was conducted in March 2025 (Ramadan 1446 H) at mosques in Banda Aceh City, Aceh Province, Indonesia. A total of 45 mosques were surveyed in this study, with the survey locations selected using random sampling (data representation with equal chances of selection, five mosques were selected to represent each district) (Agustina and Emil, 2024). Data collection was conducted in each subdistrict within the administrative region of Banda Aceh, with five mosques serving as representative samples for each subdistrict. The mosques surveyed in this study are presented in Table 1. Sampling was conducted on water storage containers built in each mosque observed (the volume and depth of the containers were not specific criteria for selecting which containers to observe).

Table 1. List of places of mosques (nine districts within the administrative area of Banda Aceh)

District	Mosque Identity	Location	Coordinate
Baiturrahman	Besar Pahlawan	Gp. Peuniti	5°32’47”N & 95°19’24”E
	Cut Meutia	Gp. Ateuk Pahlawan	5°33’4”N & 95°19’33”E
	Al-Hayat Labui	Gp. Ateuk Pahlawan	5°32’57”N & 95°19’39”E
	Baitul Makmur	Gp. Sukaramai	5°32’46”N & 95°18’46”E
	Quba	Gp. Sukaramai	5°32’48”N & 95°18’39”E
Banda Raya	Baitul Musyahadah	Gp. Geuceu Kayee Jato	5°32’10”N & 95°18’27”E
	Miftahul Jannah	Gp. Geuceu Komplek	5°31’55”N & 95°18’31”E
	Taqwa	Gp. Lhong Raya	5°31’39”N & 95°19’8”E
	Meunasah Lam Ara	Gp. Lampuot	5°31’20”N & 95°18’29”E
	Al-Furqan	Gp. Mibo	5°31’25”N & 95°18’53”E
Jaya Baru	Al-Musafir	Gp. Punge Blang Cut	5°32’27”N & 95°18’17”E
	Baitul Muqarrabin	Gp. Punge Blang Cut	5°32’49”N & 95°18’35”E
	Baiturrahman	Gp. Lampoh Daya	5°32’1”N & 95°17’19”E
	Hasbunallah	Gp. Emperon	5°32’1”N & 95°17’19”E
	Babuttaqwa	Gp. Lamtemen Baru	5°31’47”N & 95°17’43”E
Kuta Alam	Al-Badar	Gp. Kota Baru	5°33’7”N & 95°20’34”E
	Al-Abrar	Gp. Lamdingin	5°34’12”N & 95°19’45”E
	Al-Huda	Gp. Laksana	5°33’35”N & 95°19’26”E

	Al-Anshar	Gp. Mulia	5°33’47”N & 95°19’19”E
	Al-Fitrah	Gp. Bandar Baru	5°33’49”N & 95°19’54”E
Kuta Raja	Taman Dianjong	Gp. Merduati	5°33’33”N & 95°18’24”E
	Ar-Rahman	Gp. Merduati	5°33’26”N & 95°18’49”E
	Jami’ Keudah	Gp. Keudah	5°33’43”N & 95°19’1”E
	Tgk. Dianjong	Gp. Peulanggahan	5°33’53”N & 95°19’1”E
	Masjid Tuha	Gp. Lampaseh Kota	5°33’27”N & 95°18’43”E
Lueng Bata	Meunasah Lamseupeung	Gp. Lamseupeng	5°33’55”N & 95°20’3”E
	Haji Keucik Leumik	Gp. Lamseupeng	5°32’59”N & 95°20’11”E
	Ar-Rahman	Gp. Panteriek	5°32’55”N & 95°20’22”E
	Jami’	Gp. Lueng Bata	5°32’28”N & 95°20’9”E
	Meunasah Blang Cut	Gp. Blang Cut	5°32’45”N & 95°19’56”E
Meuraxa	Miftahul Jannah	Gp. Punge Ujong	5°33’3”N & 95°18’10”E
	Jami’ Baiturrahim	Gp. Ulee Lheue	5°33’21”N & 95°17’2”E
	A’itibar	Gp. Deah Glumpang	5°33’35”N & 95°17’28”E
	Al-Uswah	Gp. Deah Baro	5°33’43”N & 95°17’47”E
	Syeikh Abdurrauf	Gp. Blang Oi	5°33’12”N & 95°17’51”E
Syiah Kuala	Syuhada	Gp. Lamgugop	5°34’11”N & 95°21’19”E
	Darul Falah	Gp. Pineung	5°33’57”N & 95°20’55”E
	An-Nur	Gp. Ie Masen Kaye Adang	5°33’38”N & 95°21’0”E
	Nurul Ikhlas	Gp. Ie Masen Kaye Adang	5°33’36”N & 95°20’45”E
	Babuttaqwa Utama	Gp. Jeulingke	5°34’33”N & 95°20’51”E
Ulee Kareng	Al-Ishlahiyah	Gp. Lambhuk	5°33’16”N & 95°20’24”E
	Al-Muhyi	Gp. Pango Deah	5°32’21”N & 95°21’6”E
	Baitussalihin	Gp. Ceurih	5°33’2”N & 95°21’21”E
	Baitul Mukminin	Gp. Lamteh	5°32’55”N & 95°20’43”E
	Bustanul Aulad-Fata	Gp. Lamteh	5°33’2”N & 95°20’42”E

Note: Gp is a code used as an abbreviation for Gampoeng, which itself is a term for village in Acehnese society.

2.3. Data Collection

At each mosque, observations were conducted on *Aedes* sp. mosquito larvae in bathroom water storage containers. This study involved the collection of larvae and observations of water storage containers, including the type of container, the materials used, and bathroom conditions such as the availability of ventilation, lighting, and availability of container covers. Water samples were also collected, and both the collected larvae and water samples were analyzed in the laboratory.

2.4. Sample Examination

The collected mosquito larvae were identified based on the identification guidelines of Supriyono et al., 2023 and Yesmin et al., 2025. A total of 100 mL of water was collected from the surface of the water storage container in each observed mosque. The water samples were examined using the five in one water quality meter, which analyzed pH level, temperature (°C), salinity (%), TDS (ppm), and EC (µs/cm). The assessment of water clarity and turbidity was based on visual observations.

2.5. Data Analysis

The collected data were analyzed using several Microsoft software tools (Exel Office 2019). Descriptive analysis was used to interpret the findings of this study, and all data were visualized in the form of images, tables, and graphs. Data analysis was also conducted on distribution data using several mapping software programs (QGIS 3.30).

3. Results and Discussion

3.1. Distribution of *Aedes* sp. Larvae in Mosques of Banda Aceh During Ramadan 2025

After observing 45 mosques in Banda Aceh during ramadan 2025, this study revealed the presence of *Aedes* sp. larvae in water storage containers in the bathrooms of six mosques. Administratively, these six mosques are distributed across four districts out of the nine districts in Banda Aceh. The water storage containers in mosque bathrooms where *Aedes* sp. larvae were found are located in Baiturrahman, Lueng Bata, Syiah Kuala, and Ulee Kareng Districts (Figure 1). Interestingly, this study also found that the number of districts free from *Aedes* sp. larvae, based on observations of

mosque bathroom water storage containers, is still higher than the number of districts with *Aedes* sp. larvae in Banda Aceh. The low number of mosques in which *Aedes* sp. larvae were detected suggests that environmental hygiene management in Banda Aceh's mosques during ramadan 2025 was relatively effective. However, the presence of larvae in several locations highlights the need to further strengthen sanitation protocols. These findings underscore that the occurrence of *Aedes* sp. larvae is closely tied to the cleanliness practices implemented at each mosque. The management of hygiene in mosque bathrooms is a strong determinant of the presence or absence of *Aedes* sp. larvae.

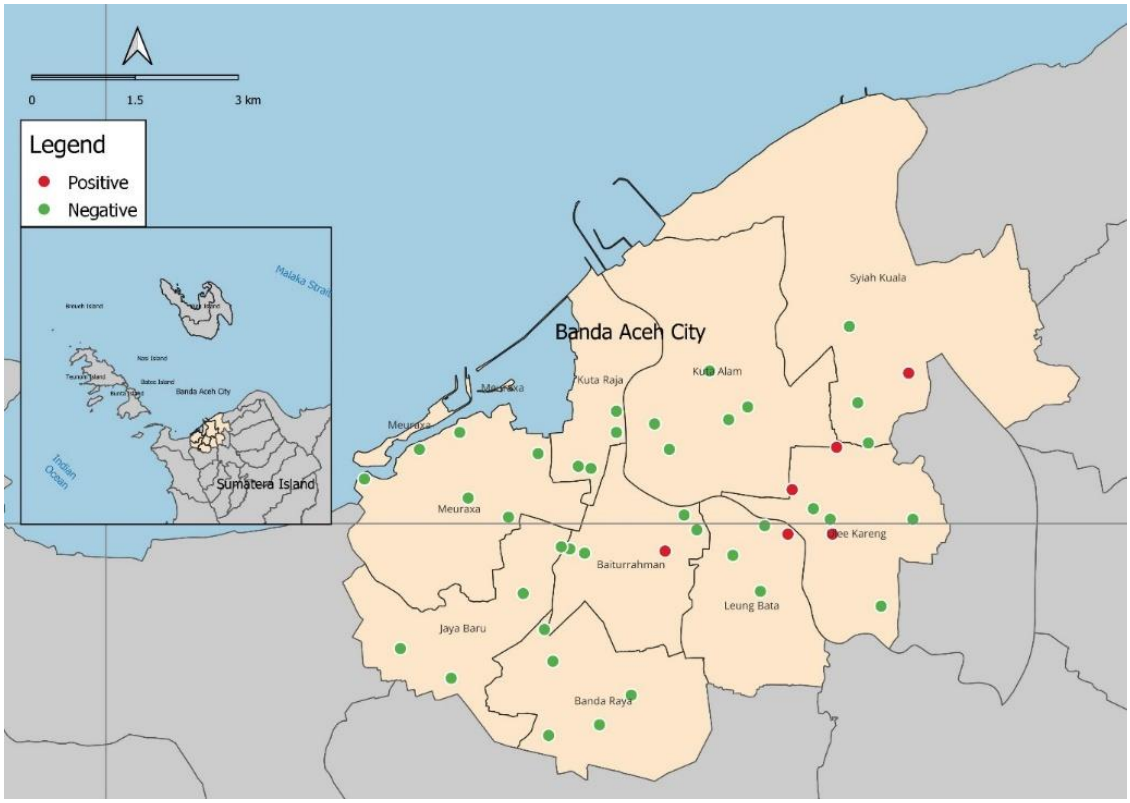

Figure 1. Map of *Aedes* sp. larvae distribution in mosques of Banda Aceh during ramadan 2025. Red markers are used to map the presence of *Aedes* sp. larvae, while green markers indicate observation sites free from *Aedes* sp. larvae.

This study highlights both differences and similarities with previous research conducted in several locations within the administrative region of Banda Aceh. Agustina and Emil, (2024) reported the presence of two *Aedes* sp. larval species in Meuraxa District, which were not found in this study. Meanwhile, the presence of *Aedes* sp. larvae in Syiah Kuala District has been documented in several previous studies, including those by Sari et al., (2010), Agustina, (2018), Agustina et al., (2019), as well as Agustina et al., and Razma et al., (2020), which are consistent with the findings of this study. Geographically, the four districts where mosque bathroom water storage containers tested positive for *Aedes* sp. larvae are adjacent to one another, indicating a possible link in larval distribution patterns. This is further supported by the findings of Arif and Agustina, (2024), Mulyadi and Agustina, (2024), and Agustina et al., (2024), who reported the presence of *Aedes* sp. larvae in Baitussalam District, Aceh Besar Regency an area bordering Syiah Kuala District, Banda Aceh City. Therefore, the detection of *Aedes* sp. larvae in Baiturrahman, Lueng Bata, Syiah Kuala, and Ulee Kareng Districts is suspected to be related to a continuous distribution pattern in these neighboring areas (Emil et al., 2024).

3.2. *Aedes* sp. Species Found in Mosques of Banda Aceh During Ramadan 2025

This study reports the presence of two *Aedes* sp. species. The collected *Aedes* sp. larvae were identified as *Aedes aegypti* and *Aedes albopictus*. These two species were found in six mosques distributed across four administrative districts. *Aedes aegypti* was detected in four mosques (8.89%), while *Aedes albopictus* was found in a smaller number, specifically in two mosques (4.44%). Information on the identified *Aedes* species is presented in Figure 2 and Table 2. The

difference between *Aedes aegypti* and *Aedes albopictus* can be observed in their spines or spinal combs. *Aedes aegypti* has sharp, curved comb spines with apical and subapical denticles at the tip, whereas *Aedes albopictus* lacks subapical denticles (Supriyono et al., 2023, Agustina and Emil, 2024, and Yesmin et al., 2025).

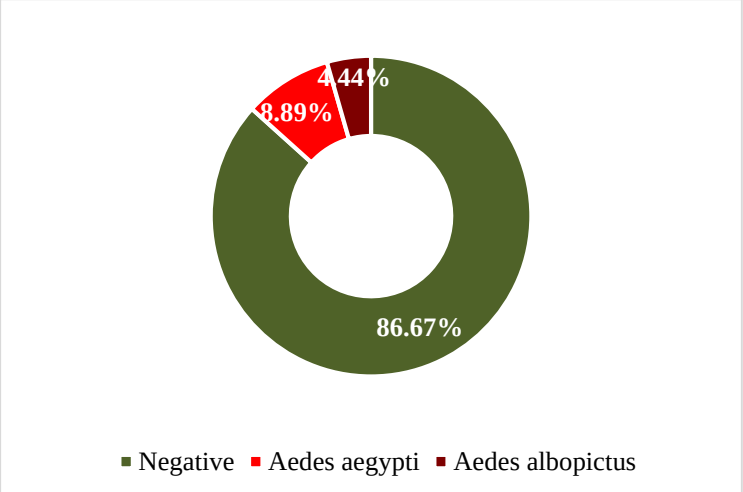

Figure 2. Two *Aedes* sp. species found in mosques of Banda Aceh during ramadan 2025.

Table 2. Results of the observation of two *Aedes* sp. species in mosques of Banda Aceh during ramadan 2025

District	Observation results		
	Negative	*Aedes aegypti*	*Aedes albopictus*
Baiturrahman	4 (80.00%)	0 (00.00%)	1 (20.00%)
Banda Raya	5 (100.00%)	0 (00.00%)	0 (00.00%)
Jaya Baru	5 (100.00%)	0 (00.00%)	0 (00.00%)
Kuta Alam	5 (100.00%)	0 (00.00%)	0 (00.00%)
Kuta Raja	5 (100.00%)	0 (00.00%)	0 (00.00%)
Lueng Bata	4 (80.00%)	1 (20.00%)	0 (00.00%)
Meuraxa	5 (100.00%)	0 (00.00%)	0 (00.00%)
Syiah Kuala	3 (60.00%)	1 (20.00%)	1 (20.00%)
Ulee Kareng	3 (60.00%)	2 (40.00%)	0 (00.00%)

Note: The results of this study are not presented based on the identity of each mosque to maintain the good name of each institution; instead, the findings are presented based on administrative location (district).

3.3. General Condition of Water Storage Facilities in the Observed Mosques and the Results of Water Sample Examination

The observation identified four types of water storage facilities in 44 mosques in Banda Aceh during Ramadan 2025 (Figure 3). Interestingly, one mosque did not have a water storage facility and relied directly on water from an iron-based faucet; this place of worship was free of larvae from both mosquito species. Plastic buckets (Figure 4) were the most commonly found water storage facilities during the study, with one positive case recorded. The other three types of water storage facilities are presented in Figure 4.

Figure 3. Water storage facilities in the 44 observed mosques. The images are arranged based on the most dominant quantity. A. plastic bucket (n = 17), B. plastic tank (n =16), concrete tank (n = 10), and concrete pot (n = 1).

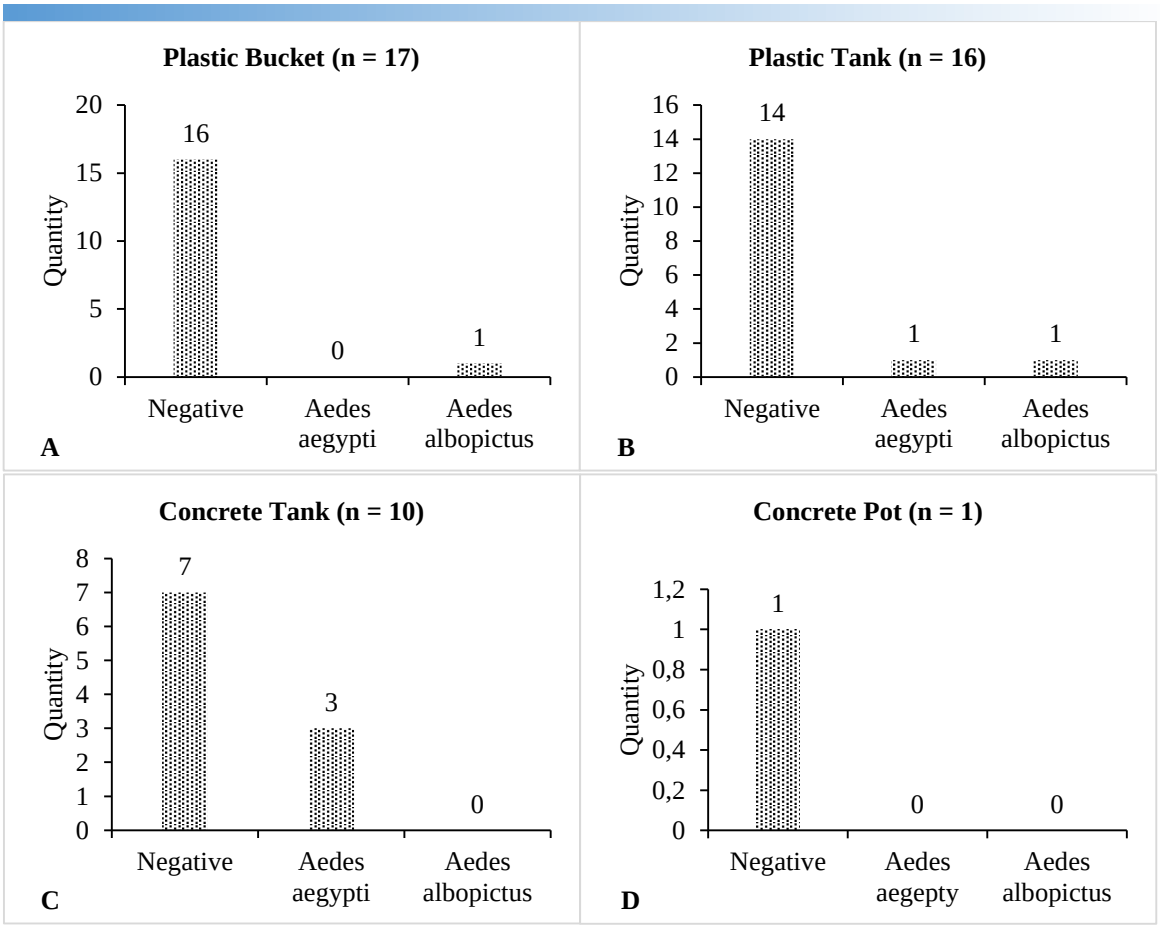

Figure 4. The frequency of encounters for each type of water storage facility (excluding iron faucets). A. plastic bucket (+ = 1, − = 16), B. plastic tank (+ = 2, − = 14), C. concrete tank (+ = 3, − = 7), and D. concrete pot (+ = 0, − = 1).

This study found various conditions in the bathrooms where water storage containers were observed. Interestingly, not all mosques had proper ventilation that could allow adult mosquitoes to pass through. The study also found that some mosques had bathrooms with limited lighting. Another notable finding was that 100% of the mosques observed in this study did not have covers on their water storage containers (Figure 5).

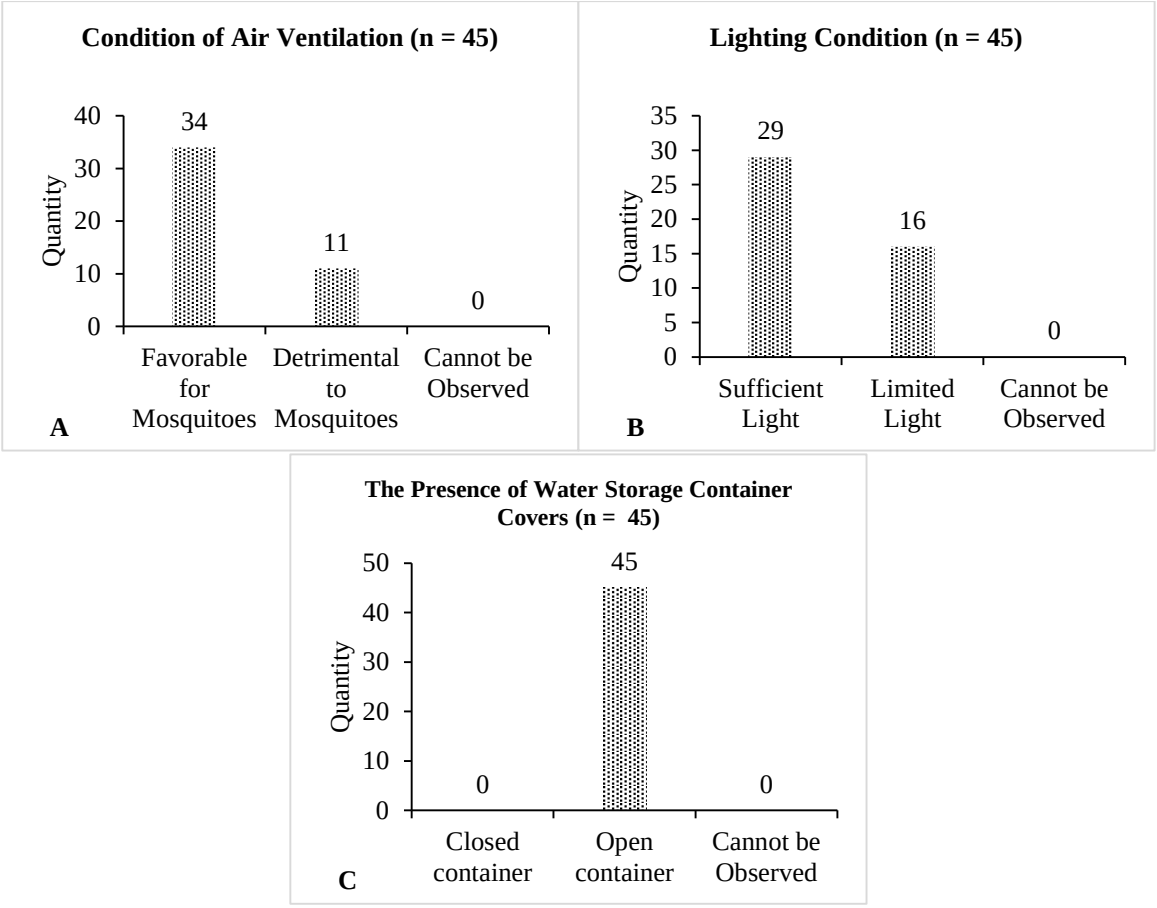

Figure 5. General conditions of the bathrooms where water storage containers were observed. A. condition of air ventilation, B. lighting condition, and C. the presence of water storage container covers.

Various measurement results were found in the examination of water samples from each water storage container. The water's acidity level, whether in containers with or without larvae (negative), ranged from pH 4 to 7. Water temperature varied between 26°C and 28°C, with salinity levels ranging from 0.01% to a maximum of 0.08%. The EC values (ppm) were recorded within the range of 121 to 856, while TDS (µs/cm) ranged from 241 to 1714 (Table 3).

Table 3. Water conditions in 45 water storage facilities in mosques in Banda Aceh during ramadan 2025. The first number presented indicates the average, with the range interval shown in parentheses.

Parameter	Condition	Measurement results
pH	Negative	6.43 (4.69−7.10)
	Aedes aegypti	6.73 (5.35−7.75)
	Aedes albopictus	6.92 (6.92−7.06)
Temperature (°C)	Negative	27.78 (26.00−28.9)
	Aedes aegypti	27.82 (26.9−28.9)
	Aedes albopictus	28.45 (28.5−28.6)
Salinity (%)	Negative	0.02 (0.01−0.08)
	Aedes aegypti	0.02 (0.01−0.03)
	Aedes albopictus	0.03 (0.03−0.03)
TDS (ppm)	Negative	252.69 (121−856)
	Aedes aegypti	314 (135−396)
	Aedes albopictus	358 (325−391)
EC (µs/cm)	Negative	502.87 (241−1714)
	Aedes aegypti	629.5 (271−793)
	Aedes albopictus	715 (653−777)

The four types of water storage containers observed in this study are generally places frequently chosen by adult *Aedes* sp. mosquitoes to lay eggs. The discovery of *Aedes* sp. larvae in plastic containers was less frequent compared to concrete containers because plastic containers have a

smaller capacity and tend to hold water that is replaced more often, making the water conditions newer and harder to sustain for long periods. Three of the containers observed, which proved to be breeding sites for *Aedes* sp. mosquitoes, have been reported in studies regarding egg-laying sites of *Aedes aegypti* (Suwito et al., 2021; Ibrahim & Roreng, 2023) and *Aedes albopictus* (Fauziyah et al., 2023). The more dominant finding of *Aedes aegypti* larvae compared to *Aedes albopictus* is due to the ecological preference of *Aedes aegypti*, which prefers indoor environments for laying eggs, while *Aedes albopictus* tends to choose outdoor sites. Consistent with this study, *Aedes aegypti* has a better habitat suitability in the environment of mosque bathrooms (Agustina and Emil, 2024).

The presence of *Aedes* sp. larvae in the bathrooms of six mosques is strongly influenced by the suitability of the mosques as breeding sites, which aligns with studies indicating that *Aedes* mosquitoes require appropriate breeding sites to survive (Agustina and Kartini, 2019). The breeding environment conditions affect the mosquito population density (Hidayati et al., 2017). Poor ventilation (allowing adult mosquitoes to enter and lay eggs), limited lighting, and the absence of covers on water storage containers are factors contributing to the bathrooms being used by *Aedes* sp. mosquitoes for egg-laying. Hidayati et al. (2017) revealed that houses with inadequate ventilation and sanitation that do not meet health standards increase the risk of mosquito density by 3.09 times, based on results from ovitrap studies. Additionally, the physicochemical conditions of the water also influence mosquito egg-laying site preferences (Agustina and Emil, 2024), where *Aedes aegypti* prefers clear water, while *Aedes albopictus* prefers murky water in mosque water storage containers. Quantitatively, the water conditions in larva-positive and larva-negative containers did not differ significantly.

Improving the management of water storage in mosques would significantly help reduce the breeding rate of mosquitoes, enhance the comfort of worship, and minimize the concerns of mosque congregants regarding the risk of dengue fever (DHF). The increase in the number of mosque congregants during ramadan should be accompanied by efforts to enhance the comfort of the worshipers, one of which is through preventive measures to minimize the space within the mosque as a breeding ground for adult *Aedes* sp. mosquitoes to lay eggs. This study recommends improving the environmental sanitation management of mosque bathrooms through several measures: using water storage containers made of plastic with limited capacity to facilitate frequent water replacement, regularly cleaning concrete containers that tend to hold large volumes of water, ensuring the availability of ventilation that prevents adult mosquitoes from entering and laying eggs, providing adequate lighting, and covering all water storage containers to eliminate potential breeding sites for mosquitoes.

4. Conclusion

During ramadan 2025, studies and observations in mosques across nine districts in Banda Aceh revealed that four districts had mosques testing positive for *Aedes* sp. larvae. This number was lower compared to areas where no larvae were found, indicating that public facility health management in Banda Aceh is relatively good. This study recorded the presence of two mosquito species: *Aedes aegypti* and *Aedes albopictus*. Mosque bathrooms where larvae were found generally require special attention, particularly in terms of material selection and water storage design, adequate ventilation and lighting, and the presence of water container covers. These two mosquito species have different habitat preferences, with *Aedes aegypti* favoring clean water in storage containers, while *Aedes albopictus* is more commonly found in less clean conditions. Future studies are essential to ensure that mosques, as public facilities, remain free from dengue fever vectors and provide a more comfortable worship environment.

REFERENCES

Agustina, E., & Emil, M.F.P. (2024). Breeding Place Preference of *Aedes* sp. at the Tsunami Area Banda Aceh City. *Journal of Biotechnology and Natural Science*, *4*(1):1-8.

Agustina, E. (2018). Fauna Nyamuk Vektor Tular Penyakit dan Tempat Perindukannya di Kawasan Kampus UIN Ar-Raniry. In *Prosiding Seminar Nasional Biologi, Teknologi dan Kependidikan* (Vol. 3, No. 1).

Agustina, E., & Kartini, K. (2019). Jenis Wadah Tempat Perindukan Larva Nyamuk *Aedes* di Gampong Binaan Akademi Kesehatan Lingkungan. In *Prosiding Seminar Nasional Biologi, Teknologi dan Kependidikan* (Vol. 6, No. 1).

Agustina, E., Leksono, A.S., Gama, Z.P., Yanuwiadi, B., & Sukma, M. (2022). Potential of House Yard Plants as an Alternative for Dengue Vector Control in the Tsunami Area Settlement of Banda Aceh City. *Journal of Applied Pharmaceutical Science*, 12(11):122-137.

Agustina, E., Muhajirin, M., & Arif, M.I. (2024). Use of Ovitrap for the Spatial Mapping of *Aedes* spp. in the Endemic Area of Dengue Fever of Baitussalam District Aceh Besar. *BIOTIK: Jurnal Ilmiah Biologi Teknologi dan Kependidikan*, 12(2):125-136.

Agustina, E., Sari, W., & Ofreza, A. (2019). Preferensi Tanaman Tempat Aktivitas *Aedes* di Pekarangan Rumah Desa Kopelma Banda Aceh. *ASPIRATOR: Journal of Vector-Borne Disease Studies*, 11(1):59–66.

Agustina, E., Sukma, M., Fitria, R., & Muhariri, W. (2020). Eksistensi Habitat Larva *Aedes* di Kampus UIN Ar-Raniry Banda Aceh pada Masa Pandemi Covid-19. *Prosiding Nasional Biotik 2020*, 12-16. *Seminar Nasional Biotik VIII, Banda Aceh, Indonesia*.

Arif, M.I., & Agustina, E. (2024, July). Use of Ovitrap for the Spatial Mapping of *Aedes* spp. in the Endemic Area of Dengue Fever of Baitussalam District Aceh Besar. In *Proceeding International Conference on Biology, Technology, Science and Education* (Vol. 1, No. 1, pp. 237-245).

Dheandri, A.A., Yuliawati, S., Hestiningsih, R., Martini, M., & Jayanti, S. (2021). Kepadatan dan Tempat Potensial Perindukan Larva *Aedes* spp. di Tempat-tempat Umum di Kecamatan Mijen Kota Semarang. *Jurnal Riset Kesehatan Masyarakat*, 1(1).

Emil, M.F.P., Priawandiputra, W., Kahono, S., & Atmowidi, T. (2024). Diversity and Nesting Ecology of Indo-Malayan Stingless Bees (*Hymenoptera*: *Apidae*) in Aceh Province, Indonesia. *Biodiversitas Journal of Biological Diversity*, 25(10):3617-3627.

Fauziyah, S., Susanti, S.F., Hariyono, Fazirrah, V., Novitasari, A.E., Fadhilah, N., Sucipto, T.H., & Naw, S.W. (2023). Phytotelmata Accounts for *Aedes* Breeding Places in Mantup Sub-district, Lamongan District, Indonesia. *Biodiversitas*, 24(9):4820-4828.

Gama, Z.P., & Agustina, E. (2022). The Dynamics of Environmental Change Pose Challenges to Preserving the Biocultural Landscape in Indonesia. In S. A. Abdullah, A. S. Leksono, & S. K. Hong (Eds.), *Conserving biocultural landscapes in Malaysia and Indonesia for sustainable development* (pp. 127-141). Springer Singapore.

Hidayati, L., Hadi, U.K., & Soviana, S. (2017). Pemanfaatan Ovitrap dalam Pengukuran Populasi *Aedes* sp. dan Penentuan Kondisi Rumah. *Jurnal Entomologi Indonesia*, 14(3):126-126.

Ibrahim, E., & Roreng, R.Y. (2023). Container Characteristics and the Presence of *Aedes aegypti* Larvae at Islamic Boarding School. *Global Scientific and Academic Research Journal of Multidisciplinary Studies*, 2(1):38-42.

Mulyadi, S., & Agustina, E. (2024, July). Effectiveness of Ovitrap for Monitoring Population Of *Aedes* sp. in Baitussalam District Aceh Besar. In *Proceeding International Conference on Biology, Technology, Science and Education* (Vol. 1, No. 1, pp. 246-252).

Nurjanah, S., Atmowidi, T., Hadi, U.K., Solihin, D.D., & Priawandiputra, W. (2021). Density and Habitat Characterization of *Aedes* sp. Breeding Places in Dengue Endemic area in Bandar Lampung. *IOP Conference Series: Earth and Environmental Science*, 1-9. *2nd Biennial Conference of Tropical Biodiversity (BCTB), Makassar, Indonesia.*

Razma, E.N., Purwanda, R., & Agustina, E. (2022, June). Sebaran Nyamuk *Aedes* di Kampus UIN Ar-Raniry Banda Aceh pada Masa Pandemi Covid-19. In *Prosiding Seminar Nasional Biologi, Teknologi dan Kependidikan* (Vol. 8, No. 1, pp. 17-21).

Rizki, L.P., & Anggreni, S.N. (2020). Community Awareness to Prevent and Control of Dengue Fever after Sunda Strait tsunami in Labuhan, Banten, Indonesia. *Journal Community Medical*, 3(1):1016.

Sari, W., Zanaria, T.M., & Agustina, E. (2010). Kajian Tempat Perindukan Nyamuk *Aedes* di Kawasan Kampus Darussalam Banda Aceh. *Biologi Edukasi: Jurnal Ilmiah Pendidikan Biologi*, 2(3):23-27.

Supriyono, Soviana, S., Musyaffa, M.F., Novianto, D., & Hadi, U.K. (2023). Morphological Characteristic of Dengue Vectors *Aedes aegypti* and *Aedes albopictus* (*Family*: *Culicidae*) using Advanced Light and Scanning Electron Microscope. *Biodiversitas Journal of Biological Diversity*, 24(2):894-900.

Suwito, Muhammad, Sugiarto, Riyanti, F., & Munar, A. (2021). Density and Habitat Preference of *Aedes aegypti* in the Outbreak of Dengue Haemorrhagic Fever Area in Sikka Regency, East Nusa Tenggara Province. *Jurnal Dunia Kesehatan Masyarakat,* 10(2):248-257.

Yesmin, F., Hasan, M.F., Hossain, T., Akter, S., Uddin, M.N., & Hasanuzzaman, M. (2025). High-Resolution Microscopic Images of Mosquito Vectors (*Diptera*: *Culicidae*): Proper Identification of *Culex* and *Aedes* during Dengue Outbreak Situation in Bangladesh. *HAYATI Journal of Biosciences*, 32(2):484-506.

Yulidar, Y. (2017). Status Angka Bebas Jentik Kota Banda Aceh sebagai Daerah Endemis Demam Berdarah Dengue Tahun 2014. *BIOTIK: Jurnal Ilmiah Biologi Teknologi dan Kependidikan,* 5(1):78-82.

Zulfa, R., Lo, W.C., Cheng, P.C., Martini, M., & Chuang, T.W. (2022). Updating the Insecticide Resistance Status of *Aedes aegypti* and *Aedes albopictus* in Asia: A Systematic Review and Meta-Analysis. *Tropical Medicine and Infectious Disease,* 7(10):306.