

Breeding Place Preference of *Aedes* sp. at the Tsunami Area Banda Aceh City

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ABSTRACT

The rebuilding of the post-tsunami community residential in Banda Aceh has had an impact on the emergence of *Aedes* habitat. The *Aedes* choose a container to breed based on biotic and abiotic factors that support their survival. This study aimed to the identification of *Aedes* species, location and type positive containers *Aedes* larvae at the area tsunami Banda Aceh. Methods an observational study of a cross-sectional approach involved 100 houses. Data larvae were collected using the single larvae method. Observations of containers were carried out in natural and artificial containers, indoors and outdoors. Positive containers *Aedes* larvae were recorded for the type of container and location found. The result of the study found two species of *Aedes*, there were *Aedes aegypti* and *Aedes albopictus*. Larvae of *Ae. aegypti* was generally found in containers indoors (71%) and containers outdoors (29%). Larvae of *Ae. albopictus* were found in containers indoors (10%) and containers outdoors (90%). The types of positive breeding containers of *Ae. aegypti* found were bathtubs (71%), discarded tires (9%), plastic drums (5%), water tanks (5%), watering pots (5%) and flower pots (5%). The containers were observed found larvae of *Ae. albopictus* were the bucket (30%), plastic drum (20%), bathtub (10%), discarded tires (10%), pet drinking place (10%), mineral water jar (10%) and coconut shells (10%). Monitoring of containers indoors and outdoors that can hold water is important supports the eradication program breeding places of *Ae. aegypti* and *Ae. albopictus*.

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1. Introduction

Tsunami cause damage to the human environment and also change the landscape. The most critical environmental problem faced by countries hit by the tsunami is health problems (Gama & Agustina, 2022). One of the health problems in the community after returning to new residences in the tsunami area of Banda Aceh is dengue hemorrhagic fever (DHF). One of the impacts of the tsunami disaster can be an increase in infectious diseases outbreaks and significant changes to the environment (Rizky & Anggreni, 2020). Most of the breeding place habitats are created by humans (Iro et al., 2020), such as water storage containers in from households (Diakaridia et al., 2022).

The habitat of *Aedes* is containers that can hold clean water both inside and outside the house. The community's habit of collecting clean water in storage containers inside and rainwater outside the house is motivated by the lack of clean water source availability. Although outdoor containers that can hold water will dried out by the dry season heat and reduce the availability of outdoor breeding containers, the water storage containers used to store daily water are still available in the house.



Positive containers *Aedes* larvae are often found indoors compared to outdoors (Athallah et al., 2020).

People's behavior that tends to hoarding used things and lack of concern for environmental cleanliness plays a role in creating environmental-based diseases. Lack of public concern for the cleanliness of their environment, such as improper management and disposal of rubbish or household waste, can be a threat to public health, such as the risk of dengue fever outbreaks (Hidayah et al., 2021). Garbage or household waste is the most often found breeding place for immature *Ae. aegypti* and *Ae. albopictus*. Plastic and glass materials have relatively slow resistivity and degradability, so people throw away or pile up these containers around their homes (Banerjee et al., 2015). The type and base material of the container is one of the characteristics that is the choice for the *Aedes* mosquito to lay eggs. *Aedes* Laying eggs in a container is influence by the type, color, location, condition of the cover and environmental conditions of the container (Daswito & Samosir, 2021). Dengue vector control has become a method applied in most countries to combat this disease. Research on the characteristics of *Aedes* habitat is important to reduce the transmission of dengue fever. This may also act as a limiting factor in the survival and dynamics of *Aedes* populations. information of the bioecology of *Aedes* is an important, especially in relating the influence of the spread and abundance of dengue fever vectors (Madzlan et al., 2016). This study was to the identification of *Aedes* species, location, and type positive containers *Aedes* larvae at the tsunami area Banda Aceh. The information obtained is initial data as a strategy for controlling *Aedes*, especially in the tsunami area of Banda Aceh.

2. Methods

2.1 Study area

Banda Aceh was severely affected by the earthquake and tsunami disasters in 2004. Consequently, the city of Banda Aceh was chosen as the study area. Banda Aceh is located at $5^{\circ}30' - 05^{\circ} 35' N$; $95^{\circ}30' - 99^{\circ} 16'E$. Banda Aceh is 0,8 meters above sea level and total area of 61.36 km² (BPS, 2019). Meuraxa subdistrict were chosen as the research sites because of the endemic dengue cases (Figure 1). Meuraxa were also the worst affected area by the tsunami.

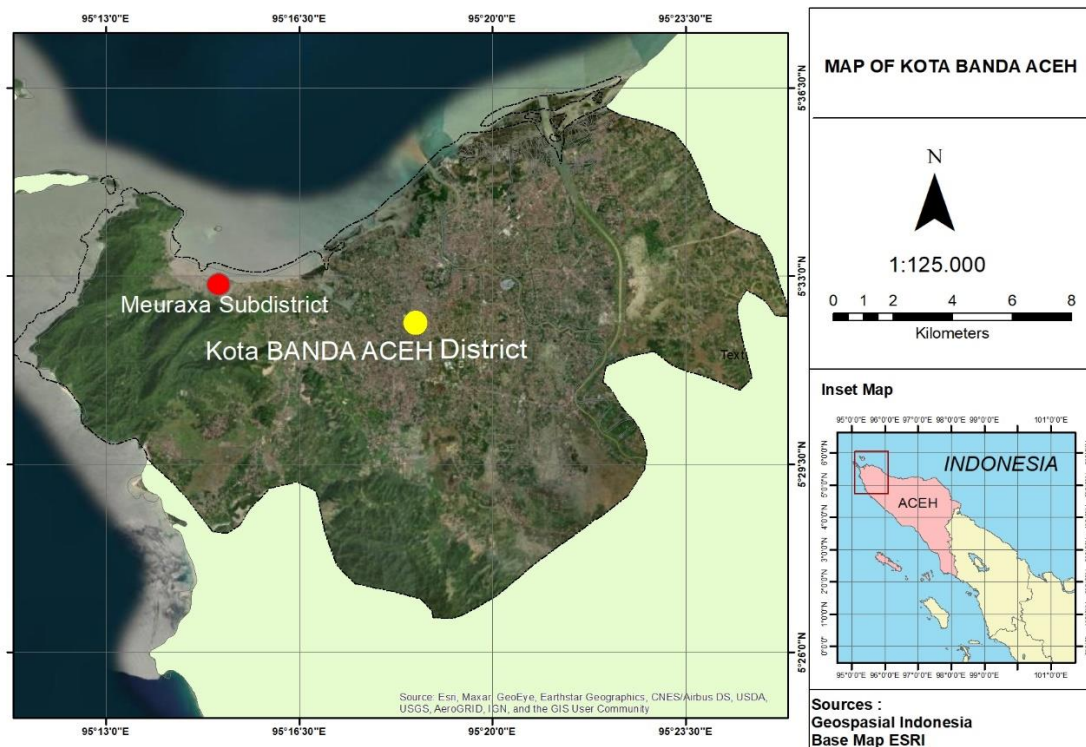


Figure 1. Location of study area.

2.2 Data collection

The research began with a preliminary survey using an exploratory method to determine the condition of houses in Meuraxa subdistrict, Banda Aceh. The research involved 100 houses taken randomly. Larvae sampling uses the single larvae method for each positive container (Departemen Kesehatan RI, 2002). Observations of containers were carried out in natural and artificial containers, indoors and outdoors. Positive containers *Aedes* larvae were recorded for the type of container and location found. There are two types of containers examined, water storage containers and non-water storage containers. Larvae collected from the breeding place were then identified to determine the species using the Indonesian Ministry of Health RI illustrated mosquito keys identification book (B2P2VRP, 2015).

2.3 Data Analysis

Research data was analyzed using descriptive statistics. Data calculated by the percentage of positive larvae containers based on the species, type of container, and finding location. Percentage data from the analysis was presented in the form of pie chart figure.

3. Results and Discussion

3.1 *Aedes* Species of Positive Containers at the Tsunami Area Banda Aceh

The research results found two species of *Aedes*, namely *Aedes aegypti* and *Aedes albopictus*. The difference between *Ae. aegypti* and *Ae. albopictus* is shown on its spines or spinal comb. *Ae. aegypti* has sharp, curved comb spines at the end it has apical and subapical denticles, while in *Ae. albopictus* does not have subapical denticles (Supriyono et al., 2023). *Ae. aegypti* was commonly found in 73%, of positive containers, while *Ae. albopictus* was only found in 27% of the positive containers. The results of research in Bangladesh showed that *Ae. aegypti* can be found in various places (8%) while *Ae. albopictus* was only found in a few places (2%). The coexisting *Ae. aegypti* and *Ae. albopictus* was only found in a limited number (1%) (Rahman et al., 2021). The percentage comparison of *Aedes*-positive containers found indoors and outdoors was presented in Figure 2.

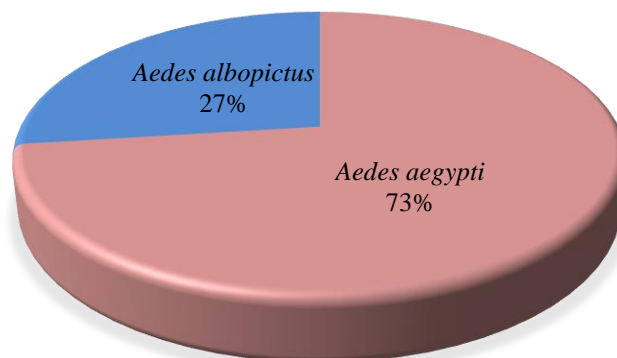


Figure 2. Percentage *Aedes* species of positive containers at the tsunami area Banda Aceh.

In general, *Ae. aegypti* larvae can be found in a wider variety of artificial and natural water storage containers compared to *Ae. albopictus*. There are more various types of breeding places for *Ae. aegypti* compared to *Ae. albopictus*. *Aedes aegypti* is able to adapt to the environment around humans. High adaptability causes the abundance of *Ae. aegypti* is high and can be found in urban and rural areas. The presence of *Ae. albopictus* in native forests and areas with river flows is commonly found (Butakka et al., 2022). Insects have a high ability to adapt to the environment, which causes insects to have a higher survival rate and can be a cosmopolitan group of animals. *Aedes* has the ability to invade and adapt to modern human ecosystems such as apartments (Zhaki et al., 2019).

3.2 The Location of Positive Containers *Aedes* Larvae at the Tsunami Area Banda Aceh

The nesting place for *Ae. aegypti* and *Ae. albopictus* in the tsunami area of Banda Aceh City was found indoors and outdoors (Figure 3). The number of larvae found indoors and outdoors because people's behavior does not pay attention to the cleanliness of their environment. That condition caused many used items that allow mosquitoes to breed in these places.

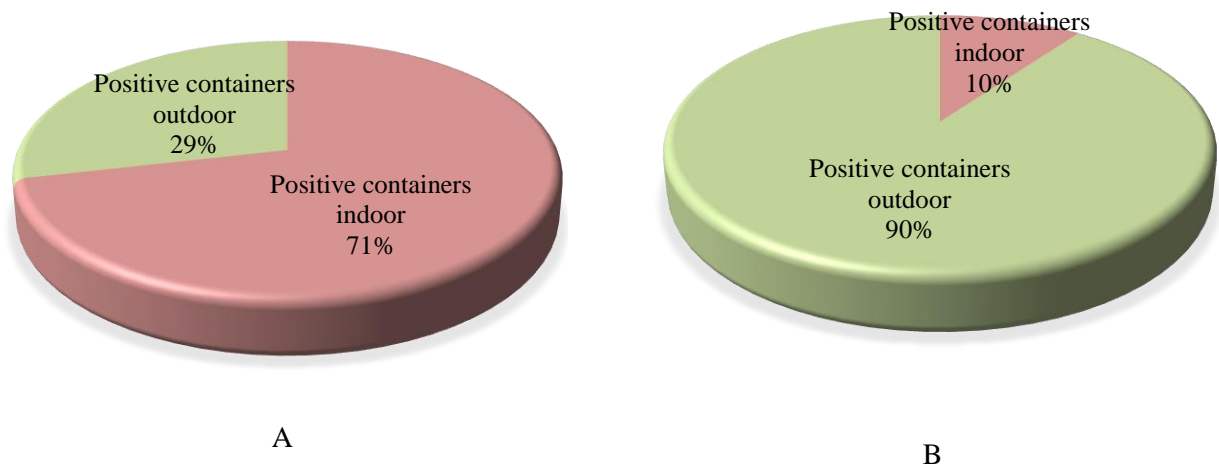


Figure 3. Percentages of positive containers *Aedes* larvae indoor and outdoor at the tsunami area Banda Aceh; A (*Aedes aegypti*), B (*Aedes albopictus*).

The Indonesian habit of storing water for daily needs in the house could be the potential mosquito breeding indoor container (Kinansi & Pujiyanti 2020). *Aedes aegypti* prefers relatively clean water in indoor containers, while *Ae. albopictus* is often found outdoors in natural containers or artificial habitats (Nurjana et al., 2023). The condition of container influences the presence of larvae. Opened containers with clean water may provide adult mosquitoes to lay their eggs (Onasis et al., 2022). Proper management of water storage containers and community-based education programs can reduce most of the *Aedes* larvae population. The outdoor presence of *Ae. aegypti* larvae and indoor presence *Ae. albopictus* larvae were related to the variation of behavior in choosing their breeding place. *Ae. aegypti* usually chooses human-made containers inside homes and tends to be closer to the human environment. In the other hand *Ae. albopictus* called as the "garden mosquito", generally prefers habitats far from house (Ratnasari, 2020). Oviposition of *Ae. aegypti* was found in dark-colored water containers in indoor and outdoor positions. However, oviposition is most often found inside the house due to the color of the container, low light availability, and humidity room conditions (Sazali et al., 2020).

3.3 Percentages of the Positive Containers *Aedes* Larvae at the Tsunami Area Banda Aceh

Aedes larvae are found in various types of containers that can hold water indoors and outdoors of the house. The type of containers where *Ae. aegypti* larvae were found were bathtubs (71%), discarded tires (9%), flower pots (5%), flower watering (5%), water tanks (5%) and plastic drum (5%) (Figure 4). Bathtub belongs to indoor container, while tires, flower pots, flower watering, water tanks, and plastic drums belong to outdoor containers. Based on the type and location of the container, *Ae. aegypti* larvae were found in the water reservoir type containers namely bathtubs, buckets, water tanks, plastic drums, and discarded tires (Suwito et al., 2021; Ibrahim & Roreng, 2023).

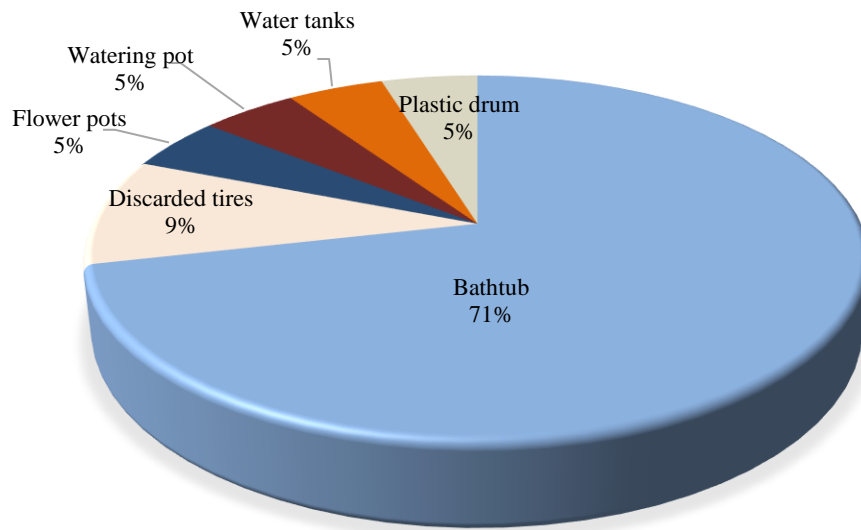


Figure 4. Percentages of positive containers of *Aedes aegypti* larvae at the tsunami area Banda Aceh.

The research results showed that *Ae. albopictus* larvae were found in artificial and natural containers (Figure 5). Outdoor containers where *Ae. albopictus* larvae are found are buckets, plastic drums, discarded tires, pet drinking places, mineral water jars, and coconut shells. Coconut shells are natural containers that are often found around the house. Coconuts are consumed by local people as food and drinks. *Aedes albopictus* larvae are commonly found in leaf axils, bamboo segments, fallen leaves, and coconut shells. The natural habitat of *Aedes* is also called phytotelmata, intensive monitoring needs to be carried out to control dengue cases (Fauziyah et al., 2023).

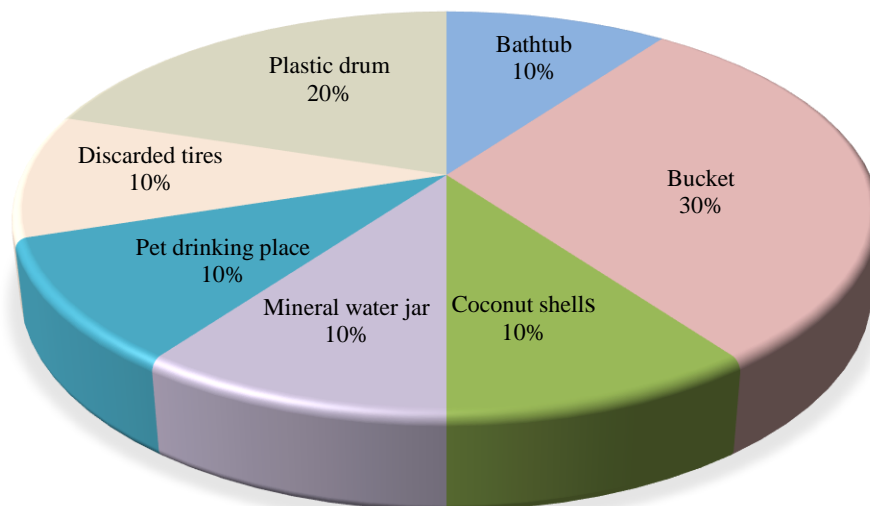


Figure 5. Percentages of positive containers of *Aedes albopictus* larvae at the tsunami area Banda Aceh.

The type of artificial container found outdoors the house as a breeding place for *Ae. albopictus* in Curug, Banten Province are flower pots, buckets, water gutters, animal food containers, plastic drums, water wells, used cans, fish ponds, and used tires (Yuliani et al., 2021). During the Covid 19

pandemic, *Ae. albopictus* can still be found in empty school buildings, wells, buckets, used cans, used tires, used bottles, flower pots, used plastic, trash cans and toilet containers (Agustina et al., 2020). Although larvae of *Ae. albopictus* is generally found outdoors, this research, larvae of *Ae. albopictus* were also found indoors container, namely bathtub. We assumed that an outdoor environment which does not support the life of *Ae. albopictus* may affect the adult mosquito breeding behavior. Unsuitable environmental conditions may influence the development of immature *Ae. albopictus* and imago survival. The indoors environment has a positive effect on the reproduction of *Ae. albopictus*. The successful percentage of eclosion survival is greater and the female mosquito lives longer in indoors environment (Cui et al., 2021). Rainfall, humidity, and temperature are significant factors influencing the abundance of *Ae. albopictus* (Muhammad & Bilal, 2022). In this research, post-tsunami environmental condition changes might significantly affect the breeding behavioral, such as moving the breeding place to a house where water is always available in any. Human and mosquito behavior could shape variety of *Aedes* habitat characteristics. Therefore, continuous monitoring must be carried out to find the right strategy for controlling dengue vectors.

4. Conclusion

In the tsunami area of Banda Aceh City, two *Aedes* species were found, namely *Ae. aegypti* and *Ae. albopictus*. The percentage of larvae of *Ae. aegypti* was found more frequently in the surveyed containers than *Ae. albopictus*. Positive container of larvae *Ae. aegypti* and *Ae. albopictus* can be found indoors and outdoors. Positive container of larvae *Ae. aegypti* were most commonly found in the bathtubs, while the containers were positive for *Ae. albopictus* was slightly higher found in buckets and plastic drums. The Changes in *Aedes* breeding behavior require further research to control the dengue vector.

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