Ovitrap use in epidemiology study of *Aedes aegypti* and *Aedes albopictus* in Kuta Alam sub-district Banda Aceh, Indonesia

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Abstract. A study on the mosquitoes *Aedes spp.* has been conducted in Kuta Alam Sub-district, Banda Aceh, to find out the percentage and distribution of positive ovitrap with eggs of *Aedes aegypti* and *A. albopictus*, based on location of ovitrap, level of rainfall as well as different landuse of settlement areas. Sampling was conducted by setting up ovitrap monthly, from January to December 2010 in settlement area that have more trees versus less trees, both indoor and outdoor. Data of the ovitrap percentage that was proved to be positive with eggs of *A. aegypti* and *A. albopictus* was analized using Student T-Test. The study revealed that rainfall value did not significantly affect (P>0.05) the percentage of positive *A. aegypti* and *A. albopictus* ovitraps and neither did the location of ovitrap (indoor versus outdoor). The settlement areas with more trees have significantly higher percentage of ovitraps containing *A. albopictus* than areas with less trees, but not significant for *A. aegypti* (P<0.05). It was suggested that rainfall and location of ovitrap did not influence the number of ovitrap containing *Aedes aegypti* and A*edes albopictus* eggs, while settlement landuse influenced significantly the percentage of positive ovitraps for *Aedes albopictus*, but not for *Aedes. aegypti.* Between two villages in Kuta Alam sub-district, it was found out that Gampong Beurawe was dominated by *Aedes albopictus* while Gampong Kuta Alam by *Aedes aegypti.* Overall, the sensitivity of ovitrap in Kuta Alam subdistrict was 83,7%. The usage of ovitrap is thus recommended for monitoring of *Aedes* spp. control programs.

Key words: *Aedes albopictus, Aedes aegypti*, ovitrap.

Introduction

Dengue and dengue haemorrhagic fever (DHF) are two of the most important epidemic diseases affecting more than 100 million people throughout the world, especially in tropical countries (Gubler and Kuno 1997). Found mainly in the urban and suburban areas, *Aedes aegypti* and *Aedes albopictus* have been incriminated as the vectors involved in the transmission of classical dengue fever (DF) and dengue haemorrhagic fever (DHF) in many urban areas of South-east Asia (Smith, 1956; Runnick, 1967). The first case of DHF was found in Manila, The Philippines, in 1963, followed by Surabaya and Jakarta in 1968, lead to 24 people died. Yet only in 1972 the disease was confirmed as DHF, and since then it spread throughout Indonesia. In 1980 all provinces in Indonesia including Aceh have been declared as DHF affected areas. In Indonesia, 600 death reported annually due to DHF (Anonimus, 2006).

The ovitrap was first developed in the United States for the surveillance of *Ae. Aegypti* (Fay & Eliason, 1966). This technique was used, as the ovitraps were found to be sensitive and efficient to detect the population of *Aedes*, even when the population densities were low (Evans & Bevier, 1969; Jakob & Bevier, 1969) and it is safe, economical and environment friendly (Chan et al., 1977). Arunachalam et al. (1999) and Lee (1992) also reported that ovitrap surveillance was a more effective and sensitive technique than conventional larval surveys, especially when the *Aedes* infestation rates were very low. Ovitrap data have also been successfully used to monitor the impact of various types of control measures involving source reduction and insecticide applications (Focks, 2003). In addition, the ovitrap method is capable of detecting mosquitoes from unexposed breeding sites and surrounding areas.

Mean temperature (^{o}C), rainfall (mm) and relative humidity (%RH) are physical factors that influence the abundance of the mosquitoes. According to Lee (1990), with the changing seasons in our country's weather, therefore there is no significant difference in larval numbers throughout the year, However, indoor temperature may provide a suitable condition for *Aedes* breeding. In general, insects are exceedingly sensitive to temperature and rainfall regiments and tropical and temperate species frequently show great variations

in seasonal abundance (Samways, 1995). Rainfall is the most important factor that affects *Aedes* breeding (Khim, 2003). Reproduction of *Ae aegypti* populations in tropical and subtropical zones occurs all year round and their abundance can either be associated with rainfall regimens (Moore et al., 1978; Chadee, 1991) or no association is observed. Generally, *Aedes* breeds after rain, not during raining days. With heavy rainfall, water in containers will overflow, and consequently larvae cannot survive in it (Lee & Cheong, 1987). Therefore, the relationships between these factors were analyzed. The effects of air temperature and precipitation on vector mosquito density were also examined in the tested areas. This information would be valuable to workers with epidemiological concerns about Dengue Fever and mosquito vectors, and for adjusting control strategies.

Materials and Method

Description and ovitraps setting

An ovitrap consists of a condensed milk cans (10,5 cm high x 7,2 cm diameter) were collected and washed toroughly and painted glossy black inside and out. A hole was made about 1 cm below the rim, to allow over flow of excess water. The paddle is about 2,0 cm wide x 12.5 cm long. It is made of hardboard, with one side smooth and the other side rough and absorbent (Pratt and Jacob, 1967; Chan, 1972; Yap, 1975). The paddle was kept in a slanting position with rough surface facing up (Arunachalam et al., 1999). Each can was filled with 200 ml of seasoned water (Sulaiman and Jeffery, 1986). Ovitrap sampling was carried out twice a month in each location for a period of 12 months. In each location, a total of 40 ovitraps were set randomly on the ground around the residential area indoors and outdoors confined to the immediate vicinity of the houses as described as Lee (1992).

A total of 40 ovitraps were set at Kuta Alam and Beurawe village. 20 ovitraps indoor and 20 others outdoor. These all ovitraps were set 5 to 20 m apart. After the ovitrap were placed, they were collected after 5 days and replaced with fresh ovitraps and paddles on the following week. The paddles collected were brought back to the laboratory. The paddles were left to dry under room temperature for at least 24 hours before the eggs on the paddles were counted under a dissecting microscope as described by Hornby et al.,(1994). In the laboratory, the paddles were air-dried for 48 hours. The number of eggs counted from each of the paddles was recorded. Paddles with eggs not hatched were air-dried for 3 days and dipped into a solution containing diluted liver powder suspension to induce hatching. Larvae were reared to adults, identified to species, and the respective numbers for *Ae. aegypti* and *Ae. albopictu*s determined. All experiments were conducted under laboratory conditions (temperature : 26 ± 4^0C and relative humidity : 60 ± 10%).

Result and Discussion

The result suggested that ovitrap is highly effective to detect the evidence of Aedes *spp*. In one area. In 12 month research timeframe, 690 out of 800 (83.7%) ovitrap set in various sites were positive containing *Aedes* spp. eggs. After determination of species based on larvae morphology, 56.3% positive ovitrap contained *Aedes aegypty* while thebrest (43.7%) contained *Aedes albopictus*. This result was similar to WHO report (2003) suggesting that ovitrap is equally efective both towards *A. aegypti* and *Aedes albopictus* (WHO,2003). If we analize according to monthly rainfall data, we found out that both *Aedes albopictus* and *Ae aegypti* have fluctuative percentage of positive ovitraps. The percentage did not show any significant different statistically ($P>0.05$) between high and low rainfall months although the average value in high rainfall months was slightly higher (54.4%) than low rainfall months (45.6%). The level of rainfal did not affect the number of mosquito eggs in the ovitrap.

The percentage of positive ovitrap has also been analized regarding land use of the villages. It showed different result for different species; for *Aedes aegypti*, Gampong Kuta Alam had higher positif percentages (60%) compared with Gampong Beurawe (40%), statistically not significant ($P>0.05$), while for *Aedes albopictus*, Gampong Beurawe had higher percentage (71.6%) compared with Gampong Kuta Alam with percentage 28.4%. *Aedes albopictus* showed significant difference ($P<0.05$) in both villages. This results indicates that *Aedes albopictus* prefers areas with many trees as their normal habitat. Judarwanto (2007) confirmed this result as he stated that *Aedes albopictus* tends to prefer

outdoor and with many trees such as garden, plantage and usually lay eggs in tree holes and branches or trunks.

In comparison between outdoor and indoor, the result revealed that *Aedes aegypti* appeared the most in ovitrap (54%) while outdoor reached only 46% ($p>0.05$). On the other hand,
Aedes albopictus showed 57% outdoor compared with 43% for *Aedes aegypti* ($P>0.05$). Although statistically not significant, these result suggested that *Aedes albopictus*, unlike *Aedes aegypti* prefered outdoor instead of indoor. Similar finding was reported in Singapore and Thailand. According to a survey conducted in urban singapore, large population of *Aedes albopictus* occurs in open spaces (Chan *et al*, 1971a). About 50% of the *Aedes albopictus* breeding occured outdoors (Chan *et al*, 1971b).

Conclusions

This study indirectly proved that ovitraps could detect the presence of *Aedes* spp in all study sites and it was clearly shown in this study that the effectiveness of ovitrap to catch *Aedes* spp. eggs is 83%. Data collected in this study are likely could provide important entomological information for the design of effective integrated vector control programme to combat Aedes mosquitoes in this area. Although the result of ovitrap surveillance can not be used to accurately estimate the total *Aedes* adult populations, the use of ovitraps in *Aedes* egg collections are sensitive and easy to perform.

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