

Occurrence of *Aedes* Larvae in Water Storage Containers in Two Areas of Pakokku Township, Magway Region

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Abstract

The study was conducted in East Chauk Kan and Kyat Htoe villages in Pakokku Township during August 2018 to October 2018 using non-intervention descriptive field investigation method. All potential breeding sites were examined as a means to implement the systematic study. Larva positive containers of different container categories as major, minor, miscellaneous containers and types were recorded. Key containers and key premises were recorded and compared. The study that 86.27% and 80.00% of households were found *Aedes* larvae positive and 56.52% of major, 50.94% of minor, 88.00% of miscellaneous and 38.14% of major, 10.84% minor and 42.86% miscellaneous containers were found to be positive for *Aedes* larvae in East Chauk Kan and Kyat Htoe villages respectively. Key containers were found to be 7.95%, 5.83% and Key premises were found to be 19.61%, 44% in East Chauk Kan and Kyat Htoe villages. The larval indices of East Chauk Kan village, observed that House Index (HI) 86.28%, Container Index (CI) 59.86% and Breteau Index (BI) 172.50% and in Kyat Htoe village larval indices were found HI 80.00%, CI 22.06% and BI 206% respectively. In East Chauk Kan village, larval indices of HI and CI were higher when compared with HI and BI of Kyat Htoe village although Breteau Index of Kyat Htoe village found higher positivity than East Chauk Kan village. Most of the larva positive containers are Bago jars, concrete tanks, drums, discarded old car tyres, bamboo stamps and manmade tree holes. Both areas indicate high positivity of larval indices and water storage containers and both areas are risk area of DF and DHF according to Pakokku RHC. Therefore, proper control method is needed to clean out the *Aedes* larvae in water reservoirs to reduce *Ae. aegypti* (the vector) that transmit and caused DF and DHF in children and as well in the adult.

Keywords: *Aedes aegypti* larvae, water storage container, key container, key premises

Introduction

Mosquitoes are the single largest group of insects, which serve as intermediate hosts in the transmission of many important human diseases as malaria, dengue fever, yellow fever and filariasis. There are three genera of mosquitoes. They are *Aedes*, *Culex* and *Anopheles*. *Aedes aegypti* is one of the world's most widely distributed mosquitoes and is of considerable medical importance as a vector of dengue and yellow fever. Mosquito is prevalent world over especially between latitude 45° north and latitude 40° south and the tropic regions. Especially in recent times, the spread space of both mosquitoes and mosquito-borne diseases has been changing and expanding for reasons such as stepping-up rates of environmental spoiling, climate changes, vector and pathogen resistance to insecticides and drugs, progressive urbanization and population movement. *Aedes aegypti* is generally thought to be the vector of dengue in more urban areas, so *Ae. aegypti* imposed higher treat. The species *Aedes aegypti* is considered as the major vector of dengue hemorrhagic fever, dengue fever and the syndrome of dengue shock (DF, DHF, DSS) in many subtropical and tropical countries throughout the world.

In the last 50 years incidence has increased 30-folds with increasing geographic expansion to new countries and in the present decade, from urban to rural setting. It is estimated that 50 million people are at risk in dengue endemic countries. The Regions of South East Asia and Western Pacific, which bear closely 75 % of the present global disease burden caused by dengue. DF and DHF are progressively becoming momentous public health problems in Myanmar

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especially among the 5-10 and 11-15-years old age groups and now noted 15 years above, a chief part of the cases happen in 5-8 years old age group. In Myanmar, the highest number of DHF cases were recorded from Irrawaddy, Kachin, Magway, Mandalay, Mon, Rakkine, Sagaing, Tanintharyi and Yangon regions. In 2007, from January to September report of VBDC revealed 9570 cases and case fatality rate is slightly above 1%. A severe outbreak of DHF occurred for the first time in Yangon in 1970. This epidemic mostly affected school going groups. Generally, more DHF cases predominate during the raining season especially in July and August. Highest number of cases was recorded in July. However, the intervals between dengue outbreaks become shorter in the past two decades. According to the report of vector bone diseases control (VBDC) in Pakokku, about 588 cases of DHF were reported with one mortality in 2016 and 184 cases of DHF in 2017 (Personal communication). Only symptomatic treatment is available for the patients. Preventive vaccines are not yet available commercially. High dengue cases in the raining season correspond to the seasonal high densities of *Aedes aegypti* mosquitoes.

Water storage practices in household for multipurpose use in city and rural areas provide year around breeding opportunities for the vector. In States and Regions *Aedes* breeding sites become established only in raining season when the local storage rain water for the domestic usages. In drawing up strategies for *Aedes* control, it is crucial that detail bionomic of the mosquito should be studied and clearly understood. Therefore, the present study was conducted in East Chauk Kan and Kyat Htoe villages of Pakokku township, Magway Region to determine the occurrence of *Aedes* larvae in water storage containers.

Materials and methods

Study Area

Periurban areas of East Chauk Kan and Kyat Htoe villages, Pakokku Township, Magway Region with high DHF prevalence within the last five years were chosen as study sites. In East Chauk Kan village a total of 198 inhabitants live in 51 houses, out of which 43 were children and in Kyat Htoe village about 148 inhabitants live in 50 houses, 37 were children. According to Pakokku RHC, the DHF cases were high in each village. Nursery and day care centers, pre and primary schools were recorded. The inspected sites were chosen randomly in each cluster.

Study Design

The study was conducted during August 2018 to October 2018 using non- intervention descriptive field investigation method. All potential breeding sites were examined in order to implement the systematic study. Larva positive containers of different categories and types were recorded and compared. The breeding sources were divided into major and minor sources. Metal drums (half or full drum), glazed or unglazed earthen jars (up to as size 30 liters), old can discarded car tyres were considered as major sources and other sources such as flower vases, small glazed earthen jars and ant-guards as minor sources. Miscellaneous container included discarded utensils and hollow bamboo poles.

Larval Indices

Larval survey was carried out in the selected sites. Larval examination method of Sheppard *et al.*, was followed to confirm the presence of larvae in the containers.

Larval indices were calculated as follows:

$$(a) \text{ Container Index (CI)} = \frac{\text{No. of positive containers} * 100}{\text{Total number of containers examined}}$$

$$(b) \text{ House Index (HI)} = \frac{\text{No. of houses positive for } Aedes \text{ aegypti} \text{ larvae} * 100}{\text{Total number of house examined}}$$

- (c) Breteau Index (BI) = No. of positive containers per 100 houses.
- (d) Key container = > 500 larvae positive per container
- (e) Key premises = 3 positive containers with *Aedes* larvae per house

Data Collection Method

Standard sheet for data collection was used to note and record for the particulars including total water holding containers with water and percentages of positive containers.

Statistical Analysis

Field data were recorded in appropriate forms and statistical analysis was conducted by using Microsoft Excel. Percentage positivity was used for comparison between selected areas.

Results

Table 1. Number of different containers categories harbouring *Aedes aegypti* larvae during survey period in East Chauk Kan and Kyat Htoe village of Pakokku Township

Survey	Total houses	Positive houses	Key container	Key premises	Containers					
					Major		Minor		Miscellaneous	
					Inspect ed	positive	Inspect ed	positive	Inspect ed	positive
East Chauk Kan	51	44 (86.27%)	7 7.95%	10 19.61%	69	39 56.52%	53	27 50.94%	25	22 88.00%
Kyat Htoe	50	40 (80%)	6 5.83%	22 44%	118	45 38.14%	286	31 10.84%	63	27 42.86%

Key container=>500 larvae positive container, Key premises = 3 and above containers positive for larvae per house)

Table 2. Comparison of larval indices of East Chauk Kan village and Kyat Htoe villages Pakokku Township

Villages	House Index (HI)	Container Index	Breteau Index
East Chauk Kan	86.28%	59.86%	172.50%
Kyat Htoe	80.00%	22.06%	206%

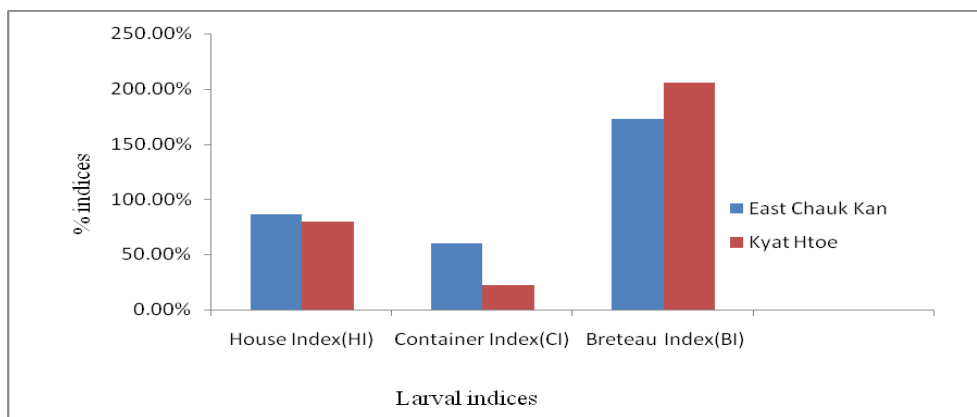


Fig. 1 Larval indices of East Chauk Kan and Kyat Htoe villages

Table (1) showed 86.27% of households were found *Aedes* larvae positive and 56.52% of major, 50.94% of minor and 88.00% of miscellaneous containers were found to be positive for *Aedes* larvae in East Chauk Kan village. Key containers were found to be 7.95%, and Key premises were found to be 19.61% in East Chauk Kan.

In Kyat Htoe village, 80.00% of the houses were found *Aedes* larvae positive and 38.14% of major, 10.84% minor and 42.86% miscellaneous containers were found to be positive for *Aedes* larvae. High percentage (44%) of Key premises and 5.83% of Key containers were found to be positive for *Aedes* larvae in Kyat Htoe village.

Table (2) showed larval indices of East Chauk Kan village, observed that House Index (HI) 86.28%, Container Index (CI) 59.86% and Breteau Index (BI) 172.50% and in Kyat Htoe village larval indices were found HI 80.00%, CI 22.06% and BI 206% respectively.

Fig. (1) showed that in East Chauk Kan village, HI and CI were found to be higher positivity when compared with HI and CI of Kyat Htoe village although Breteau Index of Kyat Htoe village found higher positivity than East Chauk Kan.

Discussion

Mosquitoes borne diseases are a major public health threat in Myanmar. The rapid growth of population and industrial installation in urban and semi-urban areas has resulted in an alarming increase in mosquito's density. Untreated stagnant water in containers originated from pipe supply, tube wells, surface wells ponds and rain water also encourage mosquito density.

The present study was conducted in two villages (East Chauk Kan village and Kyat Htoe village) Pakokku Township, Magway Region to determine the distribution of *Aedes aegypti* larvae in different water storage containers. The study found that in East Chauk Kan village, a total of 127 water storage containers (96 major, 33 minor and 25 miscellaneous) were inspected and found that 39/69 (56.52%) major containers were positive for *Aedes* larvae. Highest number of larvae were positive in Bago jar (43.59%) followed by plastic drum (23.08%). Lowest number of larvae was found in concrete jar (only one larva). Three Key containers (over 500 larvae positive container) were found in Bago jars and one metal drum was found key container.

In Kyat Htoe village, a total of 118 major, water storage containers were inspected and found that 45/118 (38.14%) of water storage containers were positive for *Aedes* larvae. Out of these Bago jar was found highest positivity followed by concrete tank (22.22%) and metal drum (22.22%). Lowest positivity rate was found in Plastic drum. Three key containers were found in major containers, of this one Bago jar, one metal drum and one concrete tank were found to be over 500 *Aedes* larvae. Some major containers as concrete tanks, metal drum and concrete jars were found with aquarian fishes and dragonfly nymphs and such containers were found absent of larvae. Other researchers also revealed that dragonfly nymphs were mostly found in concrete tanks, concrete jars and some metal drums in Yangon Region and they are predator of mosquito larvae. The larvae of *Aedes aegypti* were prevalent in the major container of Bago jars in both studied areas although in East Chauk Kan village, second most larvae positive containers included in plastic drums and metal drum but in Kyat Htoe village second most larvae positive containers were metal drums and concrete tanks as these are always full with water. Several researchers also found that metal drum, Bago jars are highly positive for *Aedes* larvae and metal drums are mostly key containers in Thakayta, Shanchaung and Dagon North Township, Yangon Region.

A total of 53 minor containers from East Chauk Kan village and 286 minor containers from Kyat Htoe village were inspected and found that highest number in small Bago jars to be positive for *Aedes* larvae. Over 40% of the small Bago jars were positive for *Aedes* larvae and a single small Bago jar was found with over 500 larvae (key container) in both areas. *Aedes* larval distribution study in Thakeyta Township revealed that the high number of *Aedes* larvae positivity in minor containers were spirit bowls and small Bago jars. Several researchers found flower vase offered on the altar and Dias were key containers in Yangon area.

A total of 25 miscellaneous containers from East Chauk Kan village and a total of 63 miscellaneous containers from Kyat Htoe village inspected for *Aedes* larvae revealed that bamboo stem was found highest positive rate in both areas (27.77% in East Chauk Kan village and 37.04% Kyat Htoe village). Manmade tree stems used as cattle food containers in cow sheds and some discarded hollowed tree trunks filled with water harboured high number of larvae were present in this container. Present study found that car tires appeared as key container in both areas and one bamboo stem from East Chauk Kan village and one tree hole were key container for *Aedes* larvae. *Aedes albopictus* was mostly found in bamboo stem and *Aedes aegypti* was in all kind of containers. Several researchers mentioned that spirit bowls are key containers of *Aedes* larvae in semi urban and rural areas of Yangon Region.

Aedes aegypti and *Aedes albopictus* larvae were observed to breed well together in the Key container of bamboo stems. Same observation of *Aedes aegypti* and *Aedes albopictus* larvae were observed in a spirit bowl in Hmawbi Township, Yangon Region. A study in Insein Township observed that *Aedes* larvae bred together with *Toxorhynchites* larvae in Car tyres. *Toxorhynchites* larvae were found easily in unused bago jars, earthen pots and discarded old car tyres¹⁹. Mostly they were found together with *Aedes* larvae due to the fact that they are predators of larvae of mosquitoes. During the present study, *Toxorhynchites* larvae were not encountered in water storage containers but dragonfly nymphs and larvivorous fish were found in some concrete tanks of both areas without *Aedes* larvae.

A total of 51 households from East Chauk Kan village and 50 households were randomly inspected and found that 44 (86.27%) and 40(80.00%) households were found to be positive for *Aedes* larvae in water storage containers. Out of these 10 Key premises (3 and above containers positive for larvae /house) 19.61% and 7 (7.95% Key container) were found in East Chauk Kan village and a total of 22 (44%) households were found Key premises and 6 (5.83%) of key containers were observed in Kyat Htoe village. Highest positivity rate of container category was found miscellaneous containers i.e. 88.00% and 42.86% in both East Chauk Kan and Kyat Htoe villages. Key containers represented Major containers as Bago jars, metal drum in both areas. The results of the present studies agreed with the results of other researchers reported high number of Key premises and Key containers in Thakeyta Township, North Dagon Township and Shwe Pyi Thar Township during the raining season. Tin Mar Yi Tun revealed that in pre-monsoon survey 62.19% of major containers were positive for *Aedes aegypti* larvae in North Dagon Township followed by 50% of Pazundaung area. Percentage of positive miscellaneous containers of Latha Township was higher than that of other Townships and also the highest percentage of positive premises (70.59%) was found in North Dagon in post monsoon period in Yangon Region. In present study key premises 22(44%) of Kyat Htoe village was higher than Key premises 7(19.61%) of East Chauk Kan village during monsoon period.

The larval detection surveys carried out in the villages of East Chauk Kan and Kyat Htoe in Pakokku Township, Magway Region recorded larval indices of East Chauk Kan village that House Index (HI) 86.28% and Container Index (CI) 69.29% were higher positivity than Kyat Htoe village (HI 80.00% and 22.06%). However, Breteau Index (172.5%) of East

Chauk Kan village was less than the Breteau Index (BI) (206%) of Kyat Htoe village. These two areas are areas of risk of DHF due to high larval indices. Similar result was revealed in Tha Kay Ta Township and North Dagon Township in Yangon Region. Positive water storage containers, Key premises and key containers were found higher in both East Chauk Kan and Kyat Htoe villages due to the fact that all the water storage containers as major, minor and miscellaneous containers were uncovered and filled with water. These conditions are favorable for the breeding of *Aedes* larvae. Adult female *Aedes* can easily find places for oviposition during the raining season. Life span of the larval shortened during raining season and enhanced the increase of *Aedes aegypti* density in monsoon period in contrast to Pe Than Htun *et al.*, (2010) reported that sometime mosquito density increased and there might be DHF outbreak in hot season because water storage habit in large major water storage containers as concrete jars and concrete jars in Dala Township in Yangon Region.

In the present study, water storage containers of key premises houses and key containers were full with water favouring the gravid female of *Aedes aegypti* to deposit their eggs in these containers. Other researches also revealed that the major containers, major breeding sources, which are usually placed under the roof gutters just outside the houses are usually replenished by rainfall. Large water containers as Bago jars and drums were found to be the main sources for breeding of *Aedes aegypti* as these containers are never completely emptied.

In control measure, some larvivorus fish species can be used as biological control agents (Molly 1924). The dragon fly nymphs *Bradinopyga germinate rambur*, were also found to be highly larvivorous. The sweeping method in larval control is a very effective control method, it can remove 95% of larvae within 10 minutes by alternate top and bottom sweeping procedures using sweeping net sweeper. In the view of the above, the spread of Dengue to both areas should be a matter of great concern to public health authorities and there is urgent need to create awareness among the populations in both East Chauk Kan and Kyat Htoe village populations. The larval control should be implemented in and around the villages especially around the school premises and day care centres.

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