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Prevalence and bionomics of *Aedes aegypti* (Linnaeus, 1762) larvaein high risk areasof Pazundaung Township, Yangon Region

Tin Mar Yi Htun*

Abstract

Dengue viruses are actively transmitted by *Aedes aegypti* in many countries in the tropical zone throughout the world including Myanmar. The successful control of this species depends on knowledge of the biology and ecology of this mosquito vector including the development and survival in different container types. A total of 31 selected places (altogether 28 compounds of 9 Primary, 4 Middle and 4 High schools, 1 local health centers and 10 private day care centers/nurseries) were surveyed seasonally to determine the prevalence and bionomics of *Aedes aegypti* larvae in different container categories and types at selected areas of Pazundaung Township in relation to children aggregated areas from December, 2017 to September, 2018.Out of 31 selected places investigated (28 compounds), 16.13% in first survey, 61.29% in second survey and 38.71% in third survey of the places were found to be larva positive.

Keywords: .*Aedes aegypti*, different container categories and types, positive premises

Introduction

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 (Service, 1992). The species is considered as the major vector of dengue, dengue haemorrhagic fever and dengue shock syndrome (DF/DHF/DSS) in many subtropical and tropical countries throughout the world. Prevention of DHF outbreaks in endemic areas is based on long-term anti-mosquito control measures particularly household and environmental sanitation with emphasis on larval source reduction. Only vector control promises permanency and a cost effective solution (Halstead, 1988).

In Myanmar, a severe outbreak of DHF occurred for the first time in Yangon in 1970. The urban areas within the Yangon City limits were more affected than the suburban townships of Yangon Division. This epidemic had an average morbidity of 51.97 per 100,000 population and affected mostly school going age groups.

Generally more DHF cases were abundant during rainy season especially in July and August. There was the highest number of cases in July (Ohn Kyi, 1985). However, the intervals between dengue outbreaks became shorter in the last two decades. High dengue cases in the rainy season correspond to the seasonal high densities of *Aedes aegypti* mosquitoes that are the vectors of DHF. Since Dengue/DHF is a mosquito-borne viral disease, only

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symptomatic treatment is available for the patients. Preventive vaccines are also not yet available commercially. Thus prevention of mosquito bite by personal protection and control of the vectors are the only methods available to prevent Dengue/DHF. In drawing up strategies for *Aedes* control, it is essential that detail biology and ecology of the mosquito should be studied and clearly understood. As the DHF cases are correlated to the density of *Aedes aegypti* of the locality, factors influencing the seasonal abundance of the vector are also needed to be studied in detail.

Yangon is situated 96º 13' 04"east longitude and 16º, 47', 56" North latitude. The population of the Yangon Division is about 7 million. Yangon Division is divided into 57 townships. Yangon City has a relatively high temperature and humidity, which are favorable conditions for the perpetuation of *Aedes aegypti*. Clinically recognizable Dengue Haemorrhagic Fever (DHF) was first noticed in 1969 in Yangon Children's Hospital which was followed by the first epidemic in Yangon, 1970 (Tun Tun Aung, 1996). The incidence of DHF increased over the two decades (1970-1980) and (1981-1991). DHF spread from Yangon to other states and divisions beginning 1975. In Yangon Division DHF transmission occurs throughout the year. But in other states and divisions the cases start to happen from May. The number rises during the rainy season of May to October. After that cases decline to less than 100 in Yangon Division. Water storage practices in Yangon Division provide year-round breeding opportunities for the vector, whereas in other states and division breeding sites get established in the rainy season only which may be the season for the high transmission at that time. The age was serious affected break-up of DHF cases is shows that the worst affected age group is 5-9 years followed by 1-4 and 10-14 years. The least affected one is 15 years and above in 1998 in Yangon Division.

Aim of the present study was to determine the prevalence and bionomics of *Aedes aegypti* immatures in different container categories and types at selected areas so as to provide basic information about larval densities of children aggregated areas. The objective of the present study is to find out the prevalence of *Aedes aegypti* immature in water containers in selected areas of suburban (Pazundaung) Townships, Yangon Division.

Materials and Methods

Study Period and Study Design

The study was conducted during December 2017 to September 2018 using non-intervention descriptive field investigation method. All potential breeding sites in suspected high risk areas were examined in order to carry out the systematic study. Larva positive containers of different container categories and types were recorded and compared in association with the seasons. The breeding sources were divided into major and minor sources. Metal drums (half or full drums), glazed or unglazed earthen jars (up to a size 30 liters), old can and discarded car tyres were considered as major sources. Other sources such as flower vases, small glazed earthen jars and ant-guards were considered as minor sources. Miscellaneous container categories contain discarded utensils and hollow bamboo pole.

Study area

Suburban (Pazundaung) townships with high DHF prevalence within the last five years were chosen as study sites. In the township, government health centers, nursery and day care centers, government primary, middle and high schools were recorded and divided into clusters. The inspected sites were chosen randomly in each cluster.

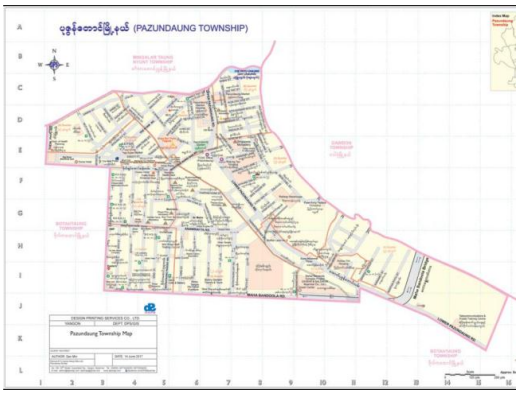
Data collection method

Standard sheet for data collection was developed and noted down the particulars including total water holding containers and percentages of positive containers.

Species Identification

Collected *Aedes aegypti* larvae were identified under the light microscope. The differences between *Aedes aegypti* and *Aedes albopictus* and other species were described based on Thailand and US keys.

Yangon Division



Pazundaung Township

Fig. 1 Study area (Source from Google map)

Results

Occurrence of mosquito larvae in different container types

Out of 31 selected places investigated (28 compounds), 16.13% (5 out of 31) in first survey, 61.29% (19 out of 31) in second survey and 38.71% (12 out of 31) in third survey of the places were found to be larva positive. (Table 1-3).

Percentage of positive containers in day care centers was significantly higher than that of the schools in all surveys. Larva positive major, minor and miscellaneous container categories were abundant in day care centers. In government and private day care centers, out of total positive container categories percentages of positive major containers were 33%, 58%, and 65% in survey 1-3, positive minor containers were 50%, 66.6%, and 92.8% in survey 1-3 and positive miscellaneous containers were 100%, 75% and 77.7% in survey 1-3 respectively.

In high-risk areas, four out of five groups (except local health centers) were found to be larva positive in all the three surveys. Out of nine places of primary schools investigated, percentages of positive premises in the three surveys were 22%, 88.8% and 44% respectively. Out of five places of middle schools positive premises were 20%, 40% and 20% in survey 1- 3 respectively and out of six places of high school they were 0%, 33% and 16% in positive premises of survey 1- 3 respectively. Out of ten places of government and private day care centers investigated in survey 1- 3 positive premises were 20%, 70% and 60% respectively.

Table 4 showed the comparison of *Aedes aegypti* larva positive container categories of three surveys. Remarkable increases of positive major and minor containers were found in second and third survey. Percentages of larva positive premises and positive containers increased in pre- monsoon season (Survey 2). (Fig 2, 3)

Table 1. Different containers habouring *Aedes aegypti* larvae in Pazundaung Township, Winter season (Survey 1)

Selected Area		Total places	Positive Premises	Containers					
				Major		Minor		Miscellaneous	
				Inspect	+	Inspect	+	Inspect	+
Primary School	9	9	2	14	1	28	1	13	0
Middle School	4	5	1	11	1	20	0	8	0
High School	4	6	0	6	0	14	0	12	0
Daycare centers	10	10	2	33	1	68	1	37	2
Health centers	1	1	0	2	0	8	0	1	0
Total	**28**	**31**	**5**	**66**	**3**	**138**	**2**	**71**	**2**

Table 2. Different containers habouring *Aedes aegypti* larvae in Pazundaung Township, Pre-monsoon season (Survey 2)

Selected Area		Total places	Positive Premises	Containers					
				Major		Minor		Miscellaneous	
				Inspect	+	Inspect	+	Inspect	+
Primary School	9	9	8	16	6	28	3	13	1
Middle School	4	5	2	11	8	22	5	11	0
High School	4	6	2	7	1	14	2	9	0
Daycare centers	10	10	7	36	21	69	20	41	3
Health centers	1	1	0	2	0	8	0	0	0
Total	**28**	**31**	**19**	**72**	**36**	**141**	**30**	**74**	**4**

Table 3. Different containers habouring *Aedes aegypti* larvae in Pazundaung Township, Post-monsoon season (Survey 3)

Selected Area		Total places	Positive Premises	Containers					
				Major		Minor		Miscellaneous	
				Inspect	+	Inspect	+	Inspect	+
Primary School	9	9	4	16	4	26	1	11	1
Middle School	4	5	1	11	2	20	0	16	0
High School	4	6	1	7	1	14	0	11	1
Daycare centers	10	10	6	36	13	67	13	30	7
Health centers	1	1	0	2	0	8	0	0	0
Total	**28**	**31**	**12**	**72**	**20**	**135**	**14**	**68**	**9**

Table 4. Comparative assessment on seasonal variation of *Aedes aegypti* larvaein Pazundaung Township

Survey	Positive containers /Total inspected containers(%)		
	Major	Minor	Miscellaneous
1	4.54	1.45	2.82
2	50	21.28	5.41
3	27.78	10.37	13.23
χ^2	35.16	16.88	6.22
p	0.00000	0.00021	0.044
	Highly significant	Highly significant	significant
	P<0.001	P<0.001	P<0.005

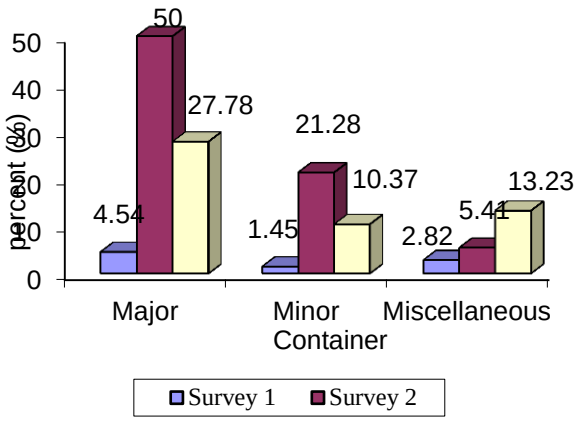


Fig 2. Seasonal variation of *Aedes aegypti* larvae in Pazundaung Township (Container)

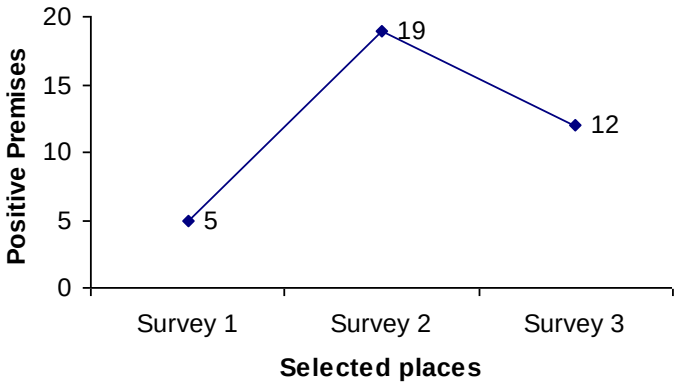


Fig 3. Seasonal variation of *Aedes aegypti* larvae in Pazundaung Township (Place)

Discussion

Aedes aegypti is the most efficient mosquito vector in transmitting the dengue virus. The female mosquito bites man during the day. After biting a person whose blood contains the virus, the female *Aedes aegypti* can transmit dengue immediately by a change of host. During the incubation period of 8-10 days, the virus multiplies in its salivary glands and can be transmitted to another person. Dengue outbreaks can be occurred by *Aedes albopictus*, *Aedes polynesiensis* and several species of the *Aedes scutellaris* complex. Each of these species has its own particular geographical distribution and they are in general less efficient vectors than *Aedes aegypti*. Man is the main reservoir of the virus though studies have shown that the monkey is the jungle reservoir in Malaysia.

Aedes aegypti is considered as the major vector of dengue/dengue hemorrhagic fever (DHF)/dengue shock syndrome (DSS) in many subtropical and tropical nations throughout the world. In Myanmar, DHF was reported for the first time in 1970 with the first major epidemic outbreak in Yangon. Since 1975 the disease has spread to other parts of the country and now occurs in all States and Divisions except Kayah and Chin.

Among the vector control methods, larval control is cost-effective (Halstead, 1988). Dengue is a worldwide problem and a common strategy approach is a realistic thing (Reiter, 1992). Emphasis should be made on the development of effective sustainable control programs based on source reduction using community participation (Service, 1992, Gubler and Clark, 1994). The detection of major containers (Key containers with high productivity of *Aedes aegypti* immatures /adults) is essential, especially in areas where young children congregate such as primary schools and day-care centers. Rapid and efficient removal of *Aedes aegypti* immatures from these key containers will no doubt reduce the child – vector contact and hopefully DHF transmission. In the present study, a metal drum with over 5000 *Aedes aegypti* immatures and another metal drum with over 2000 *Aedes aegypti* immatures were found adjacent to the primary school and day care center respectively.

The community accepted the control method of changing the stored water because it removed both the larvae and debris simultaneously. The sweep nets could be made with local materials and costed only about 1000 Kyats per net. The sweeping method is simple and can be taught to health workers and community workers in a short period.

Various water storage containers are increasing with the rapid urbanization providing breeding places for *Aedes aegypti* mosquitoes, the vector of dengue/DHF. This research work was performed to determine the prevalence of immatures of the vector in different container categories at the selected areas so as to provide basic information of larval occurrence in children aggregated areas, so called high-risk areas.

The present study emphasizes on the biology of the *Aedes aegypti* immatures. Based on this knowledge, effective control strategies should emphasize on larval source reduction which will be an important achievement for long-term vector control. The presence of *Aedes aegypti* larvae from different container categories and types were studied since these breeding sites were focal points, which were targeted in control activities.

In the present study, it can be expressed that the prevalence of larvae positive containers was not uncommon even during cool season. Breeding places were common in and around the schools and day care centers where the children aggregated during daytime. More than half of total premises inspected were *Aedes aegypti* larvae positive with high prevalence in day care centers. Out of positive premises, nearly 50% were found with 3 and above positive containers. It should also be aware of the fact that the houses, which were larval positive, were very near to the main buildings of the school. It is essential to cut down the child – vector contact by means of breeding source reduction especially key premises and key containers.

In the present study, there was a significant increase in total positive premises and positive containers as well as all three types of container categories in pre-monsoon season. The larvae were found developing in the containers even in hot season and it increased in number during monsoon season when water level rose and all container types were filled with rainwater.

DHF is often not exclusively closely associated with poor environmental sanitation, inferior housing and inadequate water supplies. The incidence of DHF has been increasing over the past 20 years and the increasing trend is still continuing. On the basis of the larval surveys carried out in suburban (Pazundaung) township and the most popular domestic water containers were Drums, Bago jars, metal tank, metal drum, concrete tank, concrete jars, clay pots, buckets and discarded plastic drum. *Aedes aegypti* larvae were mainly found in drums, Bago jars, plastic drum, concrete jars, and concrete tanks, which are the major water containers in selected studied areas. Same water containers are used in Vietnam and Thailand (Tran Vu Phong and Vu Sinti Nam, 1999; Piyarat Butraporn, Wiwat Saelim, Pongsant Sitaputra and Suwalee Tantawiwat, 1999). Key breeding sites of *Aedes aegypti* larvae were different from one place to another.

In the selected places of primary schools, middle schools, high schools, day care centres and Health Centres in the the township, the larval population size of *Aedes aegypti* was high in major domestic containers which were more productive than indoor containers due to the fact that the large containers were kept without any covers while the indoor containers were kept covered.

The major containers, major breeding sources, which are usually placed under the roof gutters just outside the houses are usually replenished by rainfall. During the peak monsoon months of June, July and August, it rains almost daily and these major key containers lying under the roof gutters are continuously replenished. The eggs of *Aedes aegypti* laid in these major-breeding sources are stimulated by rainwater for hatching. Larval and adult populations are highest in monsoon season in suburban (Pazundaung) Townships. The large water containers are found to be the main sources for breeding of *Aedes aegypti*as these containers are never completely emptied as periodical water supply was available.

In the view of the above, the spread of dengue should be a matter of great concern to public health authorities, and there is an urgent need to create awareness among the suburban population. They should be imparted necessary education about the threat and their cooperation should be elicited in the early detection and elimination of *Aedes aegypti* breeding undertaking source reduction, environmental management and personal protection measures.

In day care centres, most of the containers were positive for *Aedes aegypti* larvae in all seasons. It is noticed that the continuous breeding rate changed with the seasons in places where children were aggregated. When the schools open in pre-monsoon, May to September,

the larval control should be done in and around the school compound. All day care centres should be registered and educated to be aware of vector born diseases.

Many of the breeding places can be removed by emptying or destroying receptacles. When water pots cannot be emptied, as the water is required for human consumption, some form of covering is a simple precaution. Cisterns and other water storage devices should be made impervious to mosquitoes. Attention should be given to flower vases of the buildings. In suburban, periurban and rural areas, especially in the rainy season, disused pots and various other receptacles holding rain-water can be destroyed.

In control measure, some larvivorous fish species can be used as biological control agents (Seal, 1908; Molloy, 1924). The dragon fly nymphs, *Bradinopyga germinata* Rambur, were also found to be highly larvivorous (Sebastian, Myat Myat Thu, May May Kyaw and Myint Myint Sein, 1980). May May Kyaw (1981) conducted bionomics of *Crocothemis servilia servilia*, Tun Lin, Maung Maung Mya, Sein Maung Than and Tin Maung Maung (1995) described the sweeping method in larval control. *Aedes aegypti* immatures can be removed rapidly using the sweep net and alternate top and bottom sweeping procedures. The sweep nets could be made with local materials and are inexpensive. The sweeping method is simple and can be taught to health workers and interested community workers in less than an hour.

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