Container Breeding Preference of Dengue Vector *Aedes aegypti* in Some Endemic Areas of Monywa Township, Sagaing Region

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Aedes aegypti (*Ae. aegypti*) is found to be the principal vector of dengue virus. It is commonly found nearby human community and lays eggs preferentially in artificial containers which hold clean water. The highest number of dengue case was recorded in Monywa Township within Sagaing Region during the last five years. The present study aimed to investigate container preference of dengue vector *Ae. aegypti* in some endemic areas of Monywa Township. Entomological surveillance was carried out in Myawaddy quarter, Kamma and Kyauksitpon villages from August, 2018 to July, 2019. A total of 50 houses in each locality were visited on the basis of systematic sampling method during every month. The potential breeding habitats in the study area like cement tank, metal container, plastic container, iron drum, earthen pot, flower pot, discarded tyre and other miscellaneous were screened. Altogether 2907 water containers in Myawaddy quarter, 3322 water containers in Kamma village and 4182 water containers in Kyauksitpon village were searched in twelve months, out of which 527 (18.13%), 600 (18.06%) and 703 (16.81%), respectively, were found positive for *Ae. aegypti* breeding. Flower pot was recorded as the highest breeding preference ratio in both Myawaddy quarter had 2.96 and Kamma village had 1.72. However, the most breeding preferred ratio of *Ae. aegypti* was found 1.65 in discarded tyre for Kyauksitpon village. These results highlight that the weekly change of water in containers and elimination of non-essential containers need to be effective vector control in both urban and rural areas. Container management which reduces the sources of breeding habitats is one of the best approaches for controlling of *Aedes* mosquitoes.

Keywords: Aedes aegypti, Containers, Breeding preference ratio, Monywa Township

INTRODUCTION

Dengue is one of the major tropical mosquito borne diseases. It is a public health problem which has spread throughout tropical and sub-tropical regions of the world. Dengue is endemic in Southeast Asia, the Pacific, East and West Africa, the Caribbean and the Americas. The incidence of dengue has increased dramatically around the world in recent decades.[1] World Health Organization (WHO) estimated about 2.5 billion people (two-fifths of the world's population) were at risk for dengue.[2] In Myanmar, a total of 9,846 dengue cases with 54 deaths was recorded in 2017. Among them, 807 dengue cases were identified in Sagaing region containing Monywa Township.[3]

During the last five years, Monywa Township was recorded as the highest number of dengue

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cases within Sagaing Region by Public Health Department (Unpublished data). The dengue virus which belongs to the family flaviviridae has four serotypes. They are transmitted by the bite of the genus *Aedes* mosquitoes. However, *Aedes aegypti* (*Ae. aegypti*) is found to be the principal vector of dengue virus.[1] *Ae. aegypti* is commonly found nearby human community and lays eggs preferentially in artificial containers which hold clean water.[4] It is well adapted to urban and rural environ-ments especially man-made containers such as earthen pot, vases, water tanks, car tyres, buckets and other artificial containers. The female *Ae. aegypti* mosquitoes lay their eggs on wet walls of the containers with water.[5]

Dengue control depend on the reduction of *Ae. aegypti* populations and mosquito interactions with humans. Control strategies are based on community-based interventions to reduce, eliminate (source reduction) or treat (larvicide) *Ae. aegypti* infested containers located in and around households.[4] In Myanmar, temephos (Abate 1% sand granule) which is the organophosphate insecticide has been used to control mosquito larvae in household water containers and other breeding sources since 1979.[6]

One study in Myanmar was recorded to evaluate the occurrence of *Aedes* larvae in water storage containers in two areas of Hpa-an Township, Kayin State. The researcher identified the major, minor and miscellaneous containers in results and pointed the key container for larval control.[7] Therefore, the present study was conducted to investigate container preference of dengue vector *Ae. aegypti* in some endemic areas of Monywa Township.

MATERIALS AND METHODS

The present study was carried out by field investigation based study design from August, 2018 to July, 2019. This study was conducted in Monywa Township. It is located in the central dry zone of Myanmar. Monywa is also situated on the eastern bank of the Chindwin River, 136 kilometers west of Mandalay. The city has a population of 372,095 and is divided into 31 wards.[8]

According to the recommendation of Vector Born Disease Control unit of Sagaing Region, the study site was selected three localities which are Myawaddy quarter, Kamma village, Kyauksitpon village on the basis of the last year dengue fever cases report for the investigation of mosquito larvae in Monywa Township.

Sampling methods

The monthly mosquito larval survey was carried out by examining all containers present in houses of both urban and rural areas. A total of 50 houses in each locality were visited on the basis of systematic sampling method during every month. [9] The potential breeding habitats in the study area like cement tank, metal container, plastic container, iron drum, earthen pot, flower pot, discarded tyre and other miscellaneous were screened for the presence of immature stages of *Ae. aegypti* mosquitoes. All types of breeding habitats of *Ae. aegypti* larvae were examined around dwellings. All the water containers were searched with the help of flash light and pipette, while bigger containers were searched by sweeping the net in the water.[10]

The type of larval habitats and their location were recorded. The sample larvae collected from the breeding habitats were transported to insectary room of Medical Entomology Research Division (Pyin Oo Lwin Branch), where the larvae were reared until adult emergence. By using the pictorial keys of Leopoldo M Rueda,[11] adult mosquitoes from the rear larvae were identified.

Data analysis

Field data was recorded in appropriate forms and statistical analysis was conducted using Microsoft Excel (2013).

Breeding preference ratio (BPR)

Breeding preference ratio (BPR) of container types was detected as the following formula.[12]

$$\text{BPR} = \frac{Y}{X} \qquad \text{(BPR= Breeding preference ratio)}$$

$$Y = \frac{\text{Total number of each type containers with larvae}}{\text{Total number of all containers with larvae}} \times 100$$

$$X = \frac{\text{Total number of each type containers with water}}{\text{Total number of all containers with water}} \times 100$$

RESULTS

Myawaddy quarter

In the present study, 2907 containers with water were searched in Myawaddy quarter, out of which positive containers with *Ae. aegypti* larvae were 18.13%. Among all the breeding habitats, highest preference container of *Ae. aegypti* was recorded in flower pot followed by discarded tyre and earthen pot, respectively (Table 1).

Table 1. Breeding Preference Ratio (BPR) of *Ae. aegypti* in different breeding habitats of Myawaddy quarter, Monywa Township

Type of breeding habitats	Number of containers with water				Breeding Preferences Ratio (BPR)
	Examined	(X %)	With *Ae. aegypti* larvae	(Y %)	
Cement tank	945	32.51	153	29.03	0.89
Metal container	115	3.96	3	0.57	0.14
Plastic container	417	14.34	44	8.35	0.58
Iron drum	45	1.55	2	0.38	0.25
Earthen pot	876	30.13	207	39.28	1.30
Flower pot	13	0.45	7	1.33	2.96
Discarded tyre	105	3.61	53	10.06	2.79
Other miscellaneous	391	13.45	58	11.01	0.82
Total	2907		527		

Kamma village

As shown in Table 2, a total of 3322 water containers were searched in different breeding habitats. Of these, 18.06% positive containers were found in Kamma village. Container preference showed by the breeding preference ratio (BPR) was highest for flower pot and followed by earthen pot and cement tank, respectively.

Table 2. Breeding Preference Ratio (BPR) of *Ae. aegypti* in different breeding habitats of Kamma village, Monywa Township

Type of breeding habitats	Number of containers with water				Breeding Preferences Ratio
	Examined	(X %)	With *Ae. aegypti* larvae	(Y %)	(BPR)
Cement tank	1191	35.85	237	39.50	1.10
Metal container	69	2.08	10	1.67	0.80
Plastic container	198	5.96	19	3.17	0.53
Iron drum	70	2.11	10	1.67	0.79
Earthen pot	1183	35.61	256	42.67	1.20
Flower pot	13	0.39	4	0.67	1.72
Discarded tyre	20	0.60	3	0.50	0.83
Other miscellaneous	578	17.40	61	10.17	0.58
Total	3322		600		

Table 3. Breeding Preference Ratio (BPR) of *Ae. aegypti* in different breeding habitats of Kyauksitpon village, Monywa Township

Type of breeding habitats	Number of containers with water				Breeding Preferences
	Examined	(X %)	With *Ae. aegypti* larvae	(Y %)	Ratio (BPR)
Cement tank	926	22.14	103	14.65	0.66
Metal container	125	2.99	9	1.28	0.43
Plastic container	461	11.02	68	9.67	0.88
Iron drum	135	3.23	14	1.99	0.62
Earthen pot	1892	45.24	418	59.46	1.31
Flower pot	33	0.79	7	1.00	1.27
Discarded tyre	7	0.17	2	0.28	1.65
Other miscellaneous	603	14.42	82	11.66	0.81
Total	4182		703		

Kyauksitpon village

In this investigation, *Ae. aegypti* larval infested containers were recorded as 16.81% from the total of 4182 searching containers with water. The breeding preference of *Ae. aegypti* in eight types of artificial containers was recorded that discarded tyre was found the most preferred breeding habitats followed by earthen pot and flower pot (Table 3).

DISCUSSION

In the present study, eight types of different breeding habitats were investigated in three different areas in Monywa Township. These types were man made or artificial containers which are potential breeding sources of *Ae. aegypti* larvae in the study areas. The overall results showed that 10411 containers with water were examined in all study areas, out of these 1830 (17.58%) containers were infested with *Ae. aegypti* larvae. The highest prevalence of larvae was found in earthen pot and followed by cement tank and other miscellaneous. In all study areas, domestic earthen pots were traditionally used as drinking water pots, water storing pots and cooking pots, respectively. And then, broken pots were discarded near the house. Moreover, water storage in cement tank was secondly found based on the observation because cement is high strength and keeps cool.

In this study, flower pot was recorded as the highest breeding preference ratio in Myawaddy quarter and Kamma village, however, *Ae. aegypti* liked more discarded tyre to breeding in Kyauksitpon village. In 2015, Balakrishnan reported that the breeding preference ratio of *Ae. aegypti* were cement tank (1.88), metal container (1.15), plastic container (0.98) and other miscellaneous (0.61) in Bangalore city, India.[13] Similarly, another researcher from India investigated different types of breeding habitats and calculated the ratios with discarded tyre (1.48), iron drum (1.02), cement tank (1), flower pot (0.87), earthen pot (0.67) and plastic container (0.54), respectively.[14] According to religion, most of the people in Myanmar always use the flower pots in their houses. The present study was observed that the local people make the storing and stacking up old tires, furthermore, they hope to re-use or recycle them later.

In Kamma and Kyauksitpon villages, *Ae. Aegypti*, *Ae. albopictus* and *Ae. vitattus* were found breeding in different water holding artificial containers. *Ae. albopictus* is mostly found in relation with *Ae. Aegypti* in artificial containers that contain leaf and leaf-stalk and these containers are located under the shade especially under the tree shades.[15] The fact that *Ae. vittatus* uses artificial containers for breeding in rural ecosystems may be particularly relevant given its ability to transmit pathogens causing

human diseases.[16] However, in the present study, *Ae. aegypti* was recorded the most primary breeding species in artificial containers.

All study areas in the present study showed that the residents retained water in various containers for long time and these containers were found as the major mosquito breeding sources. Piped water supply system was not found and the water taken from tube wells and bore wells is used for the requirement of households in all study areas. Moreover, the less number of well was found in rural areas and no coverage on the numbers of residence. In Kamma village, water from two houses was distributed to all houses in village by monthly fee. Long time duration of storing water in containers make good or suitable breeding habitats for *Aedes* mosquitoes such as the artificial containers.[15]

Conclusion

Ae. aegypti population from the present study areas preferred to breed in flower pot, earthen pot, cement tank and discarded tyre rather than breed in other habitats. The elimination of the preferential breeding sites in residences is the primary function of vector control program in Myanmar. Therefore, the results of the present study emphasized the preference of *Ae. aegypti* breeding in artificial containers as a major vector control measure. Moreover, the results highlight that the weekly change of water in containers and elimination of non-essential containers need to be effective vector control in both urban and rural areas. Container management is one of the best approaches to reduce the sources of *Aedes* mosquitoes breeding habitat.[10]

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