International Journal of Mosquito Research

ISSN: **2348-5906**
CODEN: **IJMRK2**
IJMR 2019; 6(5): 44-47

Received: 19-07-2019
Accepted: 23-08-2019

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Container breeding preference of *Aedes albopictus* in urban environment

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Abstract
The comparative profusion of the aquatic level of mosquitoes in an urban area was surveyed using for different container habitats. The seasonal entomological survey was carried out at urban and peri-urban area to observe larval breeding sites, *Aedes albopictus* was the main species in the container breeding habitats. Larval collections were conducted from April 2018 to March 2019 as one in all the wet containers in and around houses of the study areas. Overall 1053 wet containers were searched in three seasons, out of which 65(6.17%) respectively, were reported, positive for *Aedes albopictus* breeding juvenile stage of *Aedes albopictus* were found in pre-monsoon, monsoon and post monsoon seasons as 2.06%, 6.87% and 6.08% respectively, in wet containers in Udaipur district. *Aedes albopictus* were mostly inspected in urban and peri-urban areas. Discarded tires (86.15%) were the most preferred microhabitat for *Aedes* breeding followed by metal pots (4.6%) and mud pots (3.07%). Increased urbanization in this area has resulted in developed of non- biodegradable containers with producing breeding habitat for *Aedes albopictus*.

Keywords: *Aedes albopictus*, breeding preference ratio, urban environment, Southern Rajasthan

1. Introduction
Dengue is the main serious vector borne viral diseases in the earth, with closely 2500 million human kinds at risk worldwide [1]. Vector borne disease has today become a serious public health issues with nearby 50-100 million cases described in completed 123 containers [2]. Dengue virus has still been newly identified in *Aedes albopictus* Skuse [3]. Which was limited to urban areas, at this time has spread to rural areas and also increasing in areas that were so long free from this disease [4]. *Aedes albopictus*, the second transmitted dengue vector of human health significance has been rapidly developing from its local range to at least 28 countries around the world, main often via the worldwide trade in used tires [5]. The distribution of *Aedes* mosquitoes are noted to be affected by environmental status. Higa declared that since the living cycle of the dengue vector is well acclimatized to the anthropoid environment and for this case, human movement that shows to climatically changes can force a large effected on the dengue mosquito distribution [6]. Saifur *et al*., (2013) reported the sequences of *Aedes* mosquitoes and their habitat designs in Penang Island and observed that rural areas reported the maximum container index, followed by semi urban and urban areas. The larva of *Aedes aegypti* was often reported in drum water reservoirs and polyethylene sheets. Further, different breeding can be reported in buckets and blank paint cans in semi urban and urban areas wherever *Aedes albopictus* larvae were reported mainly in another container and closed in fully areas [7]. *Aedes albopictus* skuse has been observed as outdoor an *Aedes* mosquito that breeds in a wide scale of natural habitat as well as artificial water filled containers [8].Thus, the main objective of this study was to decide the container preference and profusion of *Aedes albopictus* in preferred dengue liable areas. The objective of this survey was organizing *Aedes albopictus* container preference habitats to decide larval abundance, density and habitat of the urban areas of Udaipur, district from April 2018 to March 2019.

2. Materials and Methods
2.1 Study area
Udaipur is located in the state of Rajasthan in India. Udaipur is located at 24’58°N; 73.68°E. It has an average elevation of 598 meters (1961feet) and total area 64 km². Udaipur city has a hot

semi-arid climate. The climate and weather of Udaipur is usually hot. The summer season runs from Mid-March to June and touch temperature ranging from 23 °C to 44 °C the month of March to June. Monsoon arrives in the month of July heralded by dust and thunder storms. The winter season prevalence form the month of October till the month of March. The temperature ranging from 5 °C to 30 °C. Larval collection were completed concurrently in all sites following the technique of larval to regulate the *Aedes* breeding level of each water filled containers present in the houses and their sites [9]. The number of houses inspected in all sites mostly depending on the range of the area and category of houses.

2.2 Site selection
Studies were organized in urban sites of the urban, commercial and industrial areas. As well as that the forested areas, residential, automobile construction and industry areas also noticed the fast changes trend and this might, affected the figure of dengue viruses spreads.

2.3 Surveys
Peri-domestic area was observed thoroughly and the houses surveyed were selected randomly in every site. Thoroughly the immature gatherings were caught by using dipping method [10]. All available artificial larval habitats as mud pots, flower pots, discarded tires, metal pots, plastic drums, ceramic, water tanks and thermocol and other containers in indoor and outdoor sites were collected using dippers.

2.4 Identification
Larvas collected from the breeding sites were identified to examine the mosquitoes. The tools was used for identification is the stereoscopic microscope in the laboratory. *Aedes* mosquito's species were identified with the help of pictorial identification key by Leopoldo M. Rueda [11]. Each larva observed was identified and *Aedes* larval were being chosen.

3. Results
All eight microhabitat (mud pots, flower pots, discarded tires, metal pots, plastic drums, ceramic, water tanks, and thermocol) were inspected every location. A total of 1053 wet containers were detected for *Aedes albopictus* larvae. Final 65(6.17%) of the containers were reported positive. The highest number of positive container reported was at monsoon season with 42 containers and 6.87% of the positive containers being class into high larval density followed by post-monsoon with 21 containers reported with 6.08% of the containers were examined as the high level of larval density. This indicates that rainfall and temperature are an important factor for the breeding of *Aedes albopictus* in the area of Udaipur. A total number of wet containers reported and the number of containers were positive for *Aedes albopictus* larvae are introduced in figure 1. Between the eight containers inspected, 86.15%(56) of the positive for *Aedes albopictus* larvae were discarded tires followed by metal pots 4.61%(3) and plastic drums 4.61%(3). Larval level of *Aedes albopictus* were reported in 2.06%, 6.87% and 6.08% of the water filled containers in the pre-monsoon, monsoon and post-monsoon respectively, in Udaipur district.

Data of the breeding taste of *Aedes albopictus* larvae in Udaipur district are provided in table 1-3.

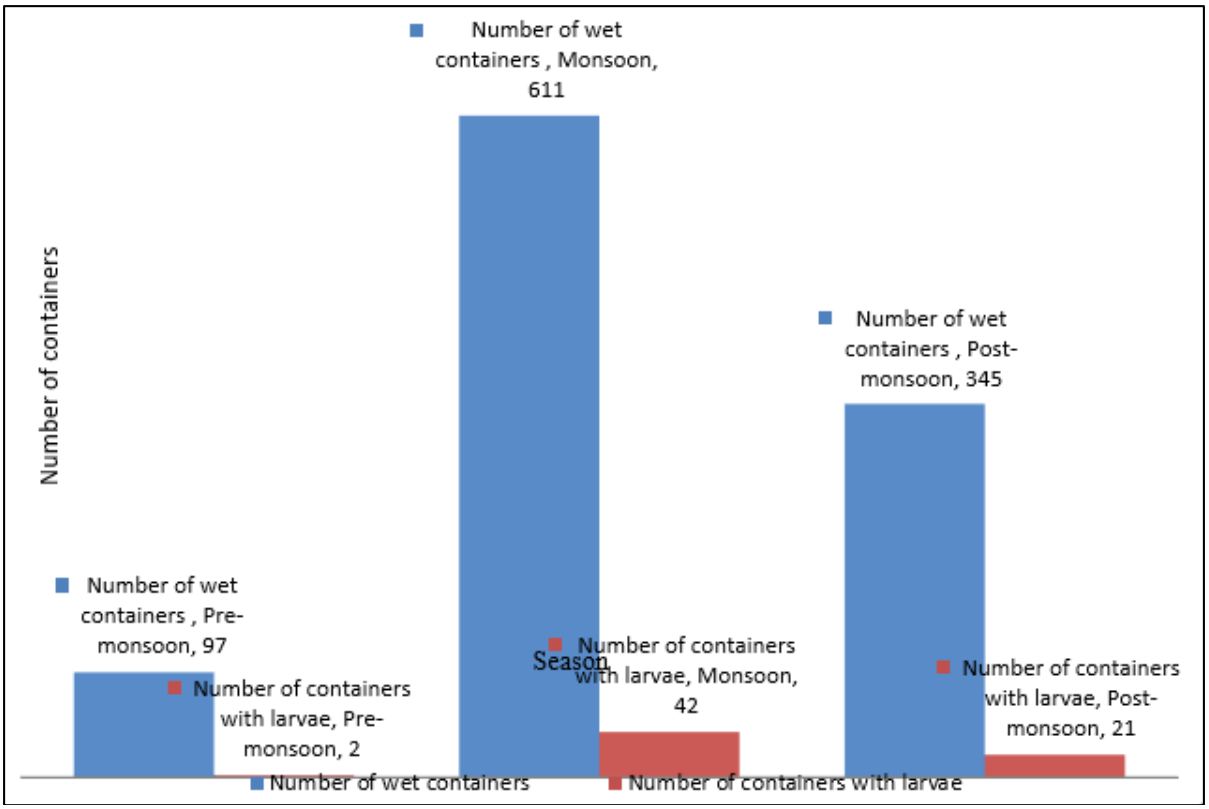

Fig 1: Seasonal distribution of number of wet containers and number of containers with larvae

Pre –monsoon survey
In the study 97 containers with water recorded in Udaipur district during the pre-monsoon season. The highest percentage of *Aedes albopictus* are found in discarded tires with 42% followed by metal pots 24.74% and other mud containers 21(7.21%)(Table-1).

Table 1: Breeding preference of *Aedes albopictus* in different artificial breeding habitats in Udaipur district, Rajasthan, during the pre-monsoon season

Types of breeding habitats	Number of wet containers	% of wet containers	Number of containers with larvae	% of positive containers	$BPR = \frac{\%\ OF\ POSITIVE\ CONTAINER}{\%\ OF\ WET\ CONTAINERS}$
Mud pots	7	7.21	0	0	0
Flower pots	4	4.12	0	0	0
Discarded tires	41	42.26	2	100	2.36
Metal pots	24	24.74	0	0	0
Plastic drum	4	4.12	0	0	0
Ceramic	5	5.15	0	0	0
Water tanks	7	7.21	0	0	0
Thermocol	5	5.15	0	0	0
Total	97		2		0

Monsoon survey

A total of 611 containers were being studied for *Aedes albopictus* larval and 42 containers were classified as positive containers, 61.21% were discarded tires, 13.74% were plastic drums and 12.43% were metal pots. All over 42 water containers were reported positive for *Aedes albopictus* in Udaipur district. Container reproduced by the breeding preference ratio was maximum for discarded tires during the monsoon season in Udaipur district (1.36), followed by (0.76) mud pots, (0.51) plastic drums and (0.38) metal pots (Table-2).

Table 2: Breeding preference of *Aedes albopictus* in different artificial breeding habitats in Udaipur district, Rajasthan, during monsoon season

Types of breeding habitats	Number of wet containers	% of wet containers	Number of containers with larvae	% of positive containers	$BPR = \frac{\%\ OF\ POSITIVE\ CONTAINER}{\%\ OF\ WET\ CONTAINERS}$
Mud pots	37	6.05	2	4.76	0.79
Flower pots	7	1.14	0	0	0
Discarded tires	374	61.21	35	83.33	1.36
Metal pots	76	12.43	2	4.76	0.38
Plastic drum	84	13.74	3	7.14	0.51
Ceramic	23	3.76	0	0	0
Water tanks	6	0.98	0	0	0
Thermocol	4	0.65	0	0	0
Total	611		42		

Post –monsoon survey

Table 3- shows the link of the containers habitats with different level of larval density. A total of 345containeres with water recorded in the post monsoon season in Udaipur district, respectively. In Udaipur district, 57.10% were discarded tires, 14.48% water tanks and 5.50% mud pots. A total of 21 containers were found positive for *Aedes albopictus* larvae and pupae.

Table 3: Breeding preference of *Aedes albopictus* in different artificial breeding habitats in Udaipur district, Rajasthan, during post-monsoon season

Types of breeding habitats	Number of wet containers	% of wet containers	Number of containers with larvae	% of positive containers	$BPR = \frac{\%\ OF\ POSITIVE\ CONTAINER}{\%\ OF\ WET\ CONTAINERS}$
Mud pots	19	5.50	0	0	0
Flower pots	9	2.60	0	0	0
Discarded tires	197	57.10	19	90.47	1.58
Metal pots	27	7.82	1	4.76	0.60
Plastic drum	16	4.63	0	0	0
Ceramic	18	5.21	0	0	0
Water tanks	51	14.78	1	4.76	0.32
Thermocol	8	2.31	0	0	0
Total	345		21		

4. Discussion

Aedes albopictus is noted to be able to breed in a broad difference of natural and artificial container natural locality. In mainly produced surveyed this species was generally found in indoor and outdoor habitats viz. earthen were jar, tin cans, rubber tires, bowls, drums and tin cans [12]. Temperature is one of the most important factors that influence the mosquito survival mostly mosquitoes. These are ectothermic [13]. Between all artificial containers found within the location plastic containers were the main prevalence breeding sites for dengue larvae. Mainly plastic containers and tires were recorded as common likely breeding habitats in three study field in Johor Malaysia [14]. According to Dom *et al.* [15], presented that reclaimable containers have a more production, beside the container type of rubber substance are reported as the maximum productivity which is range with the results of this survey. The study also recorded by Mudin (2015). Where the maximum percentage of breeding places were recorded at polystyrene meal containers, plastic bottles and tyres [16]. It also reported that *Aedes* mosquitoes minimum breed in common places for examples plant leaf axils, bamboo stumps, tree hole and coconut shell [17]. *Aedes albopictus* was found in

bamboo stumps, plastic drumps and rubber tires. Main productive areas of *Aedes aegypti* were reported at Philippines where plastic drums, metal drums [18]. This study shows it can be result that *Aedes albopictus* is settled in the urban area of Udaipur district. People are not disposed of properly of discarded tires, metal drum and plastic containers etc. These materials may increase the number of containers made available for the mosquito to for the mosquito to breed. The most state for *Aedes albopictus* mosquito positive containers and larvae were reported during monsoon season followed by the post monsoon season in the Udaipur district.

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