

Appearance of *Aedes Aegypti* Mosquito in Alobeid Town, North Kordofan State, September–November 2018, Sudan

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Abstract

The most breeding of *Aedes aegypti* mosquitoes were at indoor and outdoor water environments, including water-holding containers such as vases, jars, bathtubs, tires, garden debris, leaves, and flowerpots. The aim of the study was to survey *Aedes aegypti* larval breeding habitats and analyze vector indices. The survey was conducted in Alobeid town, North Kordofan State in the selected 17 sites during September–November 2018. The mosquito immature stage including larvae and pupal stage of the genus *Aedes* were collected from the surveyed positive containers by sweep nets. The finding of the study showed that *Aedes aegypti* was the only species detected in water containers. Out of 226 houses were inspected a number of 84 houses were found positive. From a total of 784 containers were inspected with 136 containers positive. The House index (HI) during the period from September–November, 2018 was found to be 37.2%, the Breteau index (BI) was 10.7%, and container index (CI) was 17.3% while the pupal per demographic (P/D) was 0.05. No significance differences between *Aedes aegypti* indices during different months. It can be concluded that *Aedes aegypti* was prevalent in Alobeid town. Urgent need is required for developing community ability to monitor their houses. In addition to health education sessions to provide correct health knowledge and consistent advice about proper behaviors for the community to fight *Aedes aegypti* vector.

Keywords: Alobeid Town, *Aedes aegypti*, North Kordofan State

Introduction

The *Aedes* mosquito is responsible for the transmission of many arthropod-borne viruses (arboviruses), including dengue virus, yellow fever virus, Zika virus, and chikungunya virus [1]. These arboviruses pose increasing global public health concerns because of their rapid geographical spread and increasing disease burden. In particular, dengue is the most important arboviral disease, and is widely distributed in the tropical and sub-tropical regions of the world [1]. Infected female *Aedes* mosquitoes, mainly *Aedes aegypti* (Linnaeus) and also *Ae. albopictus* (Skuse), are the main vectors of several globally important arboviruses [2]. *Ae. aegypti* (Linnaeus) is currently distributed in urban areas and usually breeds in indoor and outdoor settings in a wide variety of natural and artificial water-

holding containers such as plastic tanks, leaves, water storage jars, cement tanks, flower vases, curing tanks, glasses, rubber tires, and plastic bottles. Breeding habitats in urban areas arise mostly from neglected areas of construction sites and stagnant water that can create favorable conditions for mosquitoes to breed [3].

In countries neighboring Ethiopia, such as Sudan, Eritrea, Kenya, and Djibouti, various arboviral diseases have been reported [4]. The most entomological indicators that used for vector surveillance are; House index (HI) (percentage of houses infested with larvae and/or pupae); Container index (CI): (percentage of water-holding containers infested with larvae or pupae); Breteau index (BI): (number of positive containers per 100 houses inspected) and Pupa index (PI): (number of pupae per 100 houses inspected) [5].

Materials and Methods

Study Area

The state of North Kordofan lies in the dry zone in central Sudan between latitudes 15-11 and 45-16 north and Lengths 5 - 27.15-32 east. Bordered by six states northern state from the north, Khartoum State and White Nile from the east, South Kordofan in the south, South Darfur from the south-west and North Darfur in the west. North Kordofan state covers an area of 244,700 square km meters; equivalent to 139 square miles and 58.8 million acres of land, the state is divided into four groups: land Al gayzan, Garduod sediment, valleys, mud-cracked, it is largely an undulating plain, with the Nuba Mountains in the southeast quarter. During the rainy season from June to September, the area is fertile, but in the dry season, it is virtually deserted with an estimated population according to the census in 2008 is 2,920,992 persons distributed among the various state and localities, characterized by heterogeneous population according to geographical diversity, environmental, lifestyle, rural, urban residents and returnees [6].



Figure 1: Map of North Kordofan State

Mosquito Surveillance

The mosquito immature stage including larvae and pupal stage of the genus *Aedes* were collected from the surveyed positive containers by sweep nets. In addition, the total number of larvae counted, and approximately 10% stored for species identification. The collected larvae and pupae were kept in plastic vials with 70% ethanol. Then taxonomic identification of mosquitoes was carried out in the entomology laboratory of the Northern Kordofan State by using appropriate taxonomic keys [7].

Data Collection

The water containers in the selected 17 sites were inspected visually, and each was considered positive if either larvae or pupae were present. Data on the total number of containers present in each inspected household and the number of positive containers in each household were collected in addition to residents.

Data Analysis

Data was analyzed using SPSS version 20.0. Descriptive analyses i.e. frequency, percentage and mean were used to analyze the data. Analysis of variance was used to compare *Aedes* abundance and indices in different months. P-value considered significant at less than 0.05 levels.

Results

As shown in table 1 out of 226 houses were inspected a number of 84 houses were found positive. However, a total of 784 containers were inspected with 136 containers positive. The House index (HI) during the period from September-November, 2018 was found to be 37.2%, the Breteau index (BI) was 10.7%, and container index (CI) was 17.3% while the pupal per demographic (P/D) was 0.05.

Table 1: Overall percent of *Aedes aegypti* indices in Alobied town during September-November, 2018

No. of house inspected	Positives houses	Total container	Positive containers	Total population	No. of pupae	HI%	BI%	CI%	P/D
226	84	784	136	947	50	37.2	10.7	17.3	0.05

Table 2 shows that the high mean house index was recorded during November 2018 (46.4±3.5) % followed by September 2018 (43.9±9.9) %. Regarding Container index also the high mean of containers index was found in November 2018 (21.1±7.7) % followed by September 2018 (19. ±4.5) %. However, the high mean of Breteau index was reported during September 2018 (10.9±2.2) % and November 2018 (10.9±.6) %. Pupal per demographic shown high mean distribution during November 2018 (.05±.05) and absent during September 2018 (.00±.00). Non significance differences were found between *Aedes aegypti* indices during different months, p>0.05.

Table 2: Mean distribution of *Aedes aegypti* indices per month in Alobied town

Month	HI	CI	BI	P/D
September 2018	43.9±9.9	19. ±4.5	10.9±2.2	.00±.00
October 2018	30.0±4.9	12.0±2.3	7.7±1.5	.02±.01
November 2018	46.4±3.5	21.1±7.7	10.9±.6	.05±.05
Total	35.9±4.4	15.2±2.1	9.0±1.2	.02±.01
ANOVA (Sig.)	.284	.206	.443	.416

P-value considered significant at less than 0.05 levels

As shown in table 3, the high mean of House index was reported during rainy season (43.9±9.8) % with mean total of (35.9±4.4) %. For container index, the high mean was reported also during rainy season (19.4±4.5)% with mean total of (15.2±2.1)%. High Breteau index was shown during rainy season (10.9±2.2)% with mean total of (9.0±1.2)%. However, the high mean of pupal per demographic

was recorded in dry season (.03±.01) with mean total of (.02±.01) while no pupae found during rainy season (.02±.01). Non significance differences were found between *Aedes aegypti* indices during different seasons, p>0.05.

Table 3: Mean distribution of *Aedes aegypti* indices per season in Alobied town

Season	HI	CI	BI	P/D
Dry	32.2±4.5	13.2±2.2	8.2±1.4	.03±.01
Rainy	43.9±9.8	19.4±4.5	10.9±2.2	.00±.00
Total	35.9±4.4	15.2±2.1	9.0±1.2	.02±.01
ANOVA (Sig.)	.284	.206	.443	.416

P-value considered significant at less than 0.05 levels

Table 4 indicates that, the high mean of house index was found in Alnathir (60.0±.00)% and Alyarrmook area (60.0±.00)%. However, the high mean of container index was found in Tayba area (26.5±9.8) %. The high mean of Breatu index was found in Alyarrmook area (19.4±.00)%. Hence, the high mean of pupal per demographic was reported in Alhila Algadida (03±.03).

Table 4: Mean distribution of *Aedes aegypti* indices per area in Alobied town

Area	HI	CI	BI	P/D
Arafaat	43.5±13.5	24.7±4.7	9.6±2.1	.00±.00
Almuderia	30.0±.00	17.5±.00	7.5±.00	.00±.00
Alrahma	50.0±10.0	21.6±2.5	10.1±2.7	.05±.05
Tayba	45.0±5.0	26.5±9.8	13.1±2.0	.00±.00
Palastine	80.0±.00	22.7±.00	18. ±.00	.00±.00
Alsika hadeed	30.0±.00	10.7±.00	10. ±.000	.00±.00
Karima	.00±.00	.00±.00	.00±.00	.00±.00
Almoazafeen	20.0±.00	13.6±.00	9.10±.00	.00±.00
Riyad Alsalheen	20.0±.00	10.0±.00	10.0±.00	.00±.00
Albahath	20.0±.00	9.7±.00	3.2±.00	.00±.00
Althawra	20.0±.00	4.9±.00	4.9±.00	.00±.00
Alsalam	.00±.00	.00±.00	.00±.00	.00±.00
Alshareef	10.0±.00	6.9±.00	3.4±.00	.00±.00
Algalabia	30.0±.00	10.0±.00	10.0±.00	.00±.00
Alnathir	60.0±.00	25.8±.00	19.4±.00	.00±.00
Alyarrmook	60.0±.00	.00±.00	.00±.00	.2±.00
Alhila Algadida	44.3±.00	19.0±.00	12.2±1.3	.03±.03
Total	35.9±4.4	15.2±2.1	9.0±1.2	.02±.01
ANOVA (Sig.)	.070	.395	.057	.501

P-value considered significant at less than 0.05 levels

Discussion

The mosquito *Aedes aegypti*, consider the major vector of dengue, yellow fever and Chikingunya virus, breeds in domestic water containers. Immature mosquito's development in such containers is mainly influenced by various environmental, ecological and socioeconomic factors [8]. In urban and rural disparities in water storage practices and water source supply may affect mosquito immature abundance and, potentially, arbo-viral risk [8]. The current study showed that the *Aedes aegypti* was only species found in the selected sites of North Kordofan State. This may because *Aedes aegypti* was strongly associated with urban environments. The finding in agreement with finding that *Ae. aegypti* is the most common species along the increasing urbanization gradient and the unique *Aedes* species in urban settings [9]. The study showed

that out of 226 houses were inspected a number of 84 houses were found positive (37.2%). Hence, out of 784 containers were inspected with 136 containers positive (17.3%). Moreover, the present study showed that, the House index (HI) during the period from September-November, 2018 was found to be 37.2%, the Breatu index (BI) was 10.7%, and container index (CI) was 17.3% while the pupal per demographic (P/D) was 0.05. Similar finding obtained by Getachew et al. showed that from a total of 750 containers were inspected, and of these 405 were positive for mosquito larvae [10]. A total of 1,873 larvae were collected and morphologically identified as *Aedes aegypti* (n = 1580: 84.4%) and *Culex* (n = 293: 15.6%). The larval indices, house index, container index, and breteau index, varied from 33.3 to 86.2, from 23.2 to 73.9, and from 56.5 to 188.9, respectively. On the other hand the study showed no significance

differences between *Aedes aegypti* indices during different months. This may have been due to the similarity of annual rainfall, humidity, and temperature conditions in the area. In contrast study showed that overall, traditional *Ae. aegypti* larval indices and pupal indices were found high during the wet season [11]. While similar finding revealed that the *Aedes* larvae index remains high in both seasons [12].

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