

Original Article

Entomological investigation of *Aedes aegypti* in Kassala and Elgadarief States, Sudan

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Abstract

Background: *Aedes aegypti* is main vector species of Dengue Fever/Dengue Haemorrhagic Fever. *Aedes aegypti* is common in most of the urban areas on account of deficient water management, presence of non degradable tyres and long lasting plastic containers as well as increasing public agglomerations and inability of the public health community to mobilize the population to respond to the need to eliminate mosquito breeding sites.

Methods: A Wide entomological survey was conducted in Kassala and Elgadarief States in January 29th to February 6th 2007. Its purpose was to collect information on the presence or absence of potential *Aedes aegypti* habitats in this part of Eastern Sudan.

Breeding of *Aedes aegypti* and house, Container and Breteau indices were calculated. The landing/resting of *Aedes aegypti* and the total catch of adult mosquitoes by pyrethrum space spray was also undertaken.

Results: The results showed that, the highest *Aedes aegypti* container index was recorded in Kassala State, at Aroma locality, (27.3%) and followed by Kassala locality (21%) and Shmal Aldalta locality (15.4%). The Breteau index in this area varied from (39.6%) in the Kassala locality to (22.2%) in Shmal Aldalta locality. However, the *Aedes aegypti* house index was found to be (19%) in Kassala locality. The highest level of breeding was detected in pots (zeer) (99.7%) followed by neglected ground well in Kassala mountains (Toteel hill) (0.3%). Elgadarief State localities witnessed absence of *Aedes aegypti*.

Conclusion: These results proposed that a more urgent, systematic and sustained health education program to raise public awareness and vector control program that uses both biological and chemical control methods should be adopted to reduce *Aedes aegypti* populations to below dengue transmission thresholds.

Keywords: *Aedes aegypti*, container index, Breteau index, House index, Kassala, Elgadarief, Sudan.

Introduction

The cosmo-tropical mosquito, *Aedes aegypti* (Linn. Diptera: Culicidae), serves as the most important domestic vector of urban yellow fever and dengue^(1,2). Estimates of *Aedes aegypti* distribution and density are affected by the life-limiting factors of latitude, altitude, temperature, rainfall, humidity, season, habitat and dispersal^(3,4,5,6,7,8,9,10,11). *Aedes aegypti* is found breeding in natural receptacles such as tree holes, but always near human habitation⁽¹²⁾. In the New World, *Aedes aegypti* (Linn.) is associated with a well defined range of

immature habitats, principally small to large artificial containers⁽¹³⁾. *Aedes aegypti* breeding site preferences have been studied in many areas with varying results. Discarded automotive tires were found to be an ideal site in the USA^(14,15). *Aedes aegypti* practically never breed from egg to adult in water completely surrounded by mud. They are usually found in Zeers and other water containers in houses and coastal sailing boats, but also occur occasionally in rock and tree holes. The *Aedes aegypti* adult have White banded legs, moon-like marks on the front of the thorax or white lines on

the front legs⁽¹⁶⁾. In Sudan, in the South part *Aedes aegypti* L. species take brown or creamy scales on certain parts of the body vary considerably. In the south such scales are usually absent. However in Northern inlands areas (Bara, Wad Ashana, Sennar, Gaderief, Kassala, Wadi Halfa, etc.) some intermediate specimens are seen. Somewhat pale forms have also appeared in a laboratory stock obtained at Abdel Aziz. *Aedes aegypti* L. was widely distributed in the Southern and central Sudan and extending west of the White Nile about as far north as the 14th parallel. To the east, it has been found as far as far north as Erkowit. It has only once been found in the Nile Valley north of Khartoum, and on the coast it is entirely replaced by the variety⁽¹⁷⁾. Several indices have been described and currently used to monitor *Aedes aegypti* populations for dengue virus transmission. Those related to immature populations indicate the house index, i.e. the percentage of houses infested larvae or pupae, the container index, i.e. the percentage of water-holding of positive containers per 100 houses inspected. When using the house index or the Breatu index, the definition of house should be one unit of accommodation and the surrounding premises, irrespective of the number of people residing therein⁽¹⁸⁾. The abundance of adult mosquitoes is expressed as either the landing rate or the indoor resting density during a fixed period of collection time. Densities are recorded either as the number of adult mosquitoes per house (females, males or both) or the number of adult mosquitoes collected per unit of time. Wherever larval surveys indicate low investigations (e.g. when the Breatu index is < 5), ovitraps can be used a complementary surveillance method⁽¹⁸⁾. The objective of this survey is to collect information on the presence or absence of potential *Aedes aegypti* habitats in Kassala and Elgadarief State.

Material and methods

Entomological survey was carried out in nine localities of two Eastern States of Sudan i.e. Kassala and Elgadarief, from January 29th to February 6th 2007. Breeding of *Aedes aegypti* and house, Container and Breteau indices were calculated. However, the landing/resting of *Aedes aegypti* and the total catch of adult mosquitoes by pyrethrum space spray was also undertaken. Some of the areas had prior in the survey included those which health authorities suspected it had presence of *Aedes aegypti* according to their last survey in 2004 but not reported. For larval surveys, the basic sampling unit is the house or premise, which is systematically searched for water- holding containers. Containers are examined for the presence of mosquito larvae and pupae using a flash light. Aspiration collections of adult *Aedes aegypti* L. were made from inside houses and from the surface of containers such as pots (zeer), barrels, cisterns and cemented storage basins. The collected larvae transferred to larvae tubes in 70% alcohol while the collected adult kept in abondorph tubes with silica gel.

Results

Tables 1 and 2 include data on *Aedes aegypti* index, container index, Breatu index and habitats detected during survey in the Kassala and Elgadarief State respectively.

In Kassala State, the *Aedes aegypti* house index was found to be 19% in Kassala locality. The container index in this area varied from 27.3% in Aroma locality to 21% in Kassala locality and to 15.4% in Shmal Aldalta locality. The Breatu index was found to be 22.2% in the Kassala locality and 39.6% in Shmal Aldalta locality. Pots (zeer) considered as a preference breeding habitats of *Aedes aegypti* in the area.

Table 1: *Aedes aegypti* house index, container index and Breatu index in different localities of Kassala and Elgadarief States

Locality	House index			Container index			Breatu index
	Houses inspected	Houses positive	Percent	Container searched	Found positive	Percent	
Kassala	48	9.0	19	89	19	21	39.6
Nahr Atbra	26	0.0	0.0	38	0.0	0.0	0.0
Seteet	21	0.0	0.0	38	0.0	0.0	0.0
Aroma	25	0.0	0.0	33	9	27.3	36
Shmal Aldalta	9.0	0.0	0.0	13	2.0	15.4	22.2
Hamashkoraib	15	0.0	0.0	18	0.0	0.0	0.0
Elgadarief	84	0.0	0.0	81	0.0	0.0	0.0
Alfashaga	28	0.0	0.0	28	0.0	0.0	0.0
Alglabat	25	0.0	0.0	25	0.0	0.0	0.0
Total	281	9.0	3.2	363	30	8.3	10.7

Table 2: Types of *Aedes aegypti* breeding habitats detected during the survey

Locality	Pots (Zeer)	Percentage (%)	Hole rocks	Percentage (%)
Kassala	88	24.3	1.0	1.1
Nahr Atbra	38	10.5	0.0	0.0
Seteet	38	10.5	0.0	0.0
Aroma	33	9.1	0.0	0.0
Shmal Aldalta	13	3.6	0.0	0.0
Hamashkoraib	18	5.0	0.0	0.0
Elgadarief	81	22.4	0.0	0.0
Alfashaga	28	7.7	0.0	0.0
Alglabat	25	6.9	0.0	0.0
Total	362	99.7	1.0	0.3

Discussion

This survey has been conducted in Kassala and Elgadarief States. The survey was involved urban and rural localities. Urban localities actually witnessed infestation of *Aedes aegypti* L. The results of the survey given in table 1 and 2 showed higher indices of *Aedes aegypti* in Kassala localities, in which breeding was promoted due to high water storage practices compelled by intermittent water supply. This is consistent with DJ Lewis ⁽¹⁷⁾. The highest level of breeding was detected in pots (zeer) followed by rock hole in neglected underground well in rocks hole in Toteel hill in Kassala State.

This is consistent with Guera A, 1966, that the rock hole population has been found to be truly feral and rock hole containing immature *Aedes aegypti* occur at distances up to more than 1km from the nearest human habitation. In a brief overview of typical breeding sites around the world, *Aedes aegypti* is clearly well able to utilize any available breeding site. The findings highlighted that the *Aedes aegypti* concentrate in Kassala State while Elgadarief State was free of *Aedes aegypti*, this may be due to Presence of *Aedes* mosquito in Port

Sudan town, so there were a similar topography and climate. The results of a survey showed that *Aedes aegypti* was established in two localities in Kassala State, It was estimated that *Aedes aegypti* had expanded its range in all areas inside Kassala town .However this attributed to the sharp deficiency in water supply which made people to storage the water in different receptacles. Mixed breeding of *Aedes aegypti* and *Anopheles arabiensis* the vector of malaria, was also detected in one of the earthen pots(zeer). The landing/resting of *Aedes aegypti* undertaken by pyrethrum space spray method led to the collection of *Aedes aegypti*, *Culex quinquefasciatus*, *Anopheles arabiensis* and sand fly.

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