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The diversity and abundance of mosquito larvae in urban and rural sites of Matara area

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Abstract

Matara is one of the area continuously affected by mosquito vector borne diseases and it is within the identified endemic area for urban filariasis. During the past few years numbers of dengue patients gradually increased within the Matara district. Many studies were done on the biology of these two mosquito vectors throughout the country. However the studies on the diversity and abundance of other mosquito species in Matara area were not done extensively compared to these two vector groups.

Since the larvae of many mosquitoes confined to small aquatic habitats, larval survey could be use as good indictors to study the diversity of adult mosquitoes. Quality of these larval habitats could be varying with both natural factors; weather and intra-specific competition and anthropogenic activities. So the present study was mainly aimed to findout the diversity and abundance of mosquito larvae with special reference to anthropogenic activities in Matara area. In the study areas especially in urban sites there were much favorable sites for breeding of mosquitoes, such as natural and man-made containers, which filled with rainwater and polluted water. But in rural site there were less breeding places comparatively urban areas. In this study there were six mosquito larval species were recorded namely *Armigerus subalbatus, Culex quinquefasciatus, Culex hutchinsoni, Culex tritaeniorhynchus, Aedes albopictus* and *Aedes egypti.*

For each site House index (HI), Container Index (CI) and Bretaeu Index (BI) were calculated. Although HI, CI and BI of urban sites higher than that of the rural sites but there was no significant difference among urban and rural sites.

Introduction

Mosquitoes are one of the most important groups of ectoparasitic insects, which transmit serious diseases throughout the world. Despite large scale control efforts these mosquito vector borne diseases continue to be major public health problems causing serious epidemics in time to time (Service, 1986).

There are about 140 species of mosquitoes are found in Sri Lanka (Jayasekara and Chelliah, 1981). Among them several species of mosquitoes belong to genera *Anopheles, Culex* and *Aedes* are important as vectors of deadly diseases such as Dengue, Encephalitis and Malaria and disfiguring disease, filariasis in Sri Lanka.

The life cycle of mosquito include four stages; Egg, larva, pupa and adult and the duration of each stage and life cycle depend on some of abiotic factors, particular the temperature. All mosquito larvae require water to develop and adults of *Culex*, *Anopheles* and *Mansonia* species lay their eggs on water surface. Adults of *Aedes* and *Haemogogus* species deposit their eggs just above the waterline of the damp substrate. These eggs can withstand desiccation for weeks, months or even years. In tropics eggs usually hatch within about 2 – 3 days (Service, 1986).

Habitats of these mosquito larvae vary considerably and range from smaller temporary collection of water in various natural and artificial containers to large and permanent collection of water including fresh water swamps and marshes. They are usually absent from large rivers and fast flowing waters.

Being a tropical country Sri Lanka has suitable climatic conditions such as temperature, rainfall and humidity for mosquitoes to breed throughout the year. Physical factors such as topography, soil factors and nature of the land, also influence the distribution and diversity of these mosquitoes. Socio- economic factors such as development schemes and projects, urbanization and movements of people also very important as these activities influence the abundance of several man-biting mosquito species and the spread of diseases transmitted by them. In addition to that man himself influences the abundance of mosquitoes by providing suitable habitats for their development (Dissanaike, 1984).

Mapping of the distribution of the parasites and vectors were done in various instances and these surveys have clearly revealed that the Matara area is endemic to Bancroftian filariasis transmitted by *Culex quinquefasciatus*. In addition to that number of Dengue patients was recorder from Matara district during past few years. Most of the vector surveys and investigations were focused on these particular vector species and studies on the other mosquito species were not done to that extent.

Therefore the main objective of the present study was to find out the diversity and abundance of mosquito larvae in selected sites of Matara area. Since the survey of the larval stages will be a good indicator for the population size and diversity of adult mosquitoes in a given area (WHO, 1992) larval collection was carried out to as the main sampling method.

Materials and Methods

A. Study area

The study was carried out in Matara, which is the southern most end of the "endemic coastal belt" of Bancroftian filariasis in Sri Lanka. Four study sites were selected for the present study. Polhena and Hittatiya were selected as urban sites while Godagama and Talpawila were selected as rural sites.

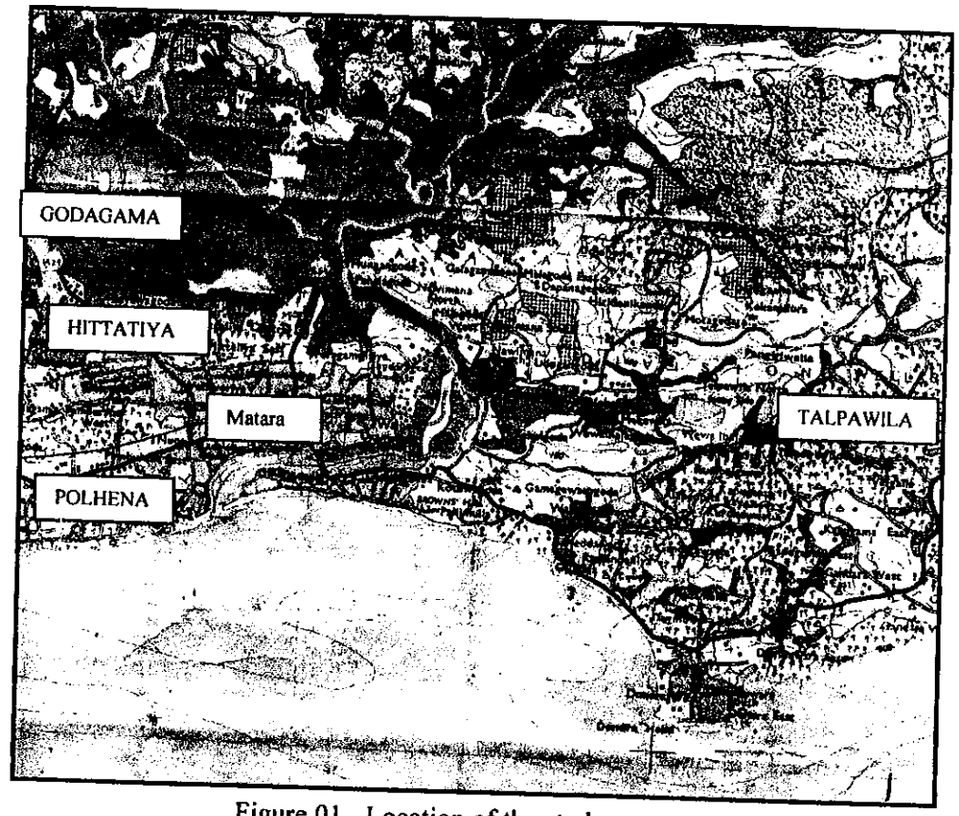

Figure 01 - Location of the study area

Polhena is situated about 3 Km South-west of the Matara town along the coastal belt. The area comprises with large number of houses such as asbestos roofed wooden houses and mud wall houses, tile roofed brick–walled houses and small Coconut plantations scattered in between. Coconut husk pits are common along the coastal line. These pits are favorable breeding sites for *Culex quinquefasciatus*. This area is recognized as an endemic area for Bancroftian filariasis and several studies were carried out on the epidemiology of the parasite and the vector (Weerasooriya, 1995, 1998, 2001).

Hittatiya is situated about 2 Km in the landside of the Matara town. It comprises with both residential houses and shop houses. It is rather highly populated area and large

plantations cannot be seen. Drainage water cannels are badly maintained and blocked with household effluents. Houses comprise with brick walled houses with tile–roofed or asbestos roofed. Artificial water containers (Tanks) are present in most of the houses, which are highly preferable breeding sites for *Aedes* sp.

Godagama is a rural village about 6 Km North -west from the Matara town. Houses varied from Tile –roofed, asbestos –roofed with brick- walled houses to mud –walled houses. Coconut and vegetable plantations are common in that area. There is a marshy land in one side of the village.

Talpawila is also a rural village situated about 6 Km East to the Matara town. Houses are various types from Tile-roofed, Asbestos –roofed with brick –walled houses and mud walled houses. Paddy and Coconut plantations are very common.

A.1 Larval collection

A preliminary visit was done prior to the sampling and at each site five houses were selected randomly. The study was carried out three months from Early May to late July. The entomological collections were done in selected houses in each site twice a month during the daytime.

Mosquito larval collection was done in both indoor and outdoor containers. The breeding sites of mosquitoes such as Flower vases and traps, small pools, tin cans, ditches and drains, ponds, tyres, Coconut husks, Coconut floral spathes, Tree holes were examined and counted separately. The larvae were collected into labeled glass vials using a dropper and preserve in 70% Alcohol until the identification using taxonomic characters.

The mosquito larvae were mounted into a slide by using Phenol and identified by using the taxonomic keys (Service, 1986) and the assistance by Anti-filarial Unit, Matara.

Abundance of mosquito larvae was calculated using the House Index (HI), Container Index (CI) and Breteau Index (BI). (Thavara *et al.* 2001)

$$\text{House Index} = \frac{\text{Number of positive containers}}{\text{Number of containers inspected}} \times 100$$

$$\text{Container Index} = \frac{\text{Number of houses infested}}{\text{Number of houses inspected}} \times 100$$

$$\text{Breteau Index} = \frac{\text{Number of positive containers}}{\text{Number of houses inspected}} \times 100$$

Results

A. Mosquito larvae

No mosquito larvae were found in indoor containers throughout the study period. In contrast, six mosquito larvae species were found at each outdoor site. *Armigerus subalbatus, Culex quinquefasciatus* and *Aedes albopictus* were prominent species in all four sampling sites. Occurrence of six larval mosquito species at each sampling sites are summarized in Table 01.

Aedes albopictus, were found only in Hittatiya site while *Culex hutchinsoni* and *Culex tritaeniorhynchus* were collected only from Polhena and Godagama sites, respectively.

Table 01 - Occurrence of mosquito larval species at each sampling sites

	Urban sites		Rural sites	
Species name	Hittatiya	Polhena	Talpawila	Godagama
Armigerus subalbatus	√	√	√	√
Culex quinquefasciatus	√	√	√	√
Aedes albopictus	√	√	√	√
Aedes egypti	√			
Culex hutchinsoni				√
Culex tritaeniorhynchus		√		

In urban sites, five mosquito larval species were recorded, but only four mosquito larval species were found at rural sites. *Culex tritaeniorhynchus* was found only at Polhena (urban site), and *Culex hutchinsoni* was recorded only from Godagama, which was one of the two rural sites.

A.1 Larval Indices

Larval indices were calculated by the larvae collected from each sampling sites and obtained **HI (House Index), CI (Container Index)** and **BI (Breteau Index)** at each sampling occasions in four sampling sites are summarized in Table 02.

Out of these examined containers there were no positive containers for mosquito larvae inside the houses. Mosquito larvae were present in the containers found in outside of the houses. It was clear that larval indices **HI, CI** and **BI** were higher in Polhena and followed by the Godagama (Figure 02).

Table 02 - HI, CI and BI of each sampling occasions in each sites

Larval Index	Sampling site	Sampling dates					
		Early May	Late May	Early June	Late June	Early July	Late July
HI	Hittatiya	-	60	60	20	-	20
	Polhena	80	80	60	40	20	20
	Talpawila	20	20	40	-	-	20
	Godagama	60	60	40	60	-	-
CI	Hittatiya	-	17	18	4	-	3
	Polhena	38	21	11	9	5	3
	Talpawila	4	4	7	-	-	4
	Godagama	10	21	7	26	-	-
BI	Hittatiya	-	80	100	20	-	20
	Polhena	260	180	60	60	20	20
	Talpawila	20	20	40	-	-	20
	Godagama	60	120	40	140	-	-

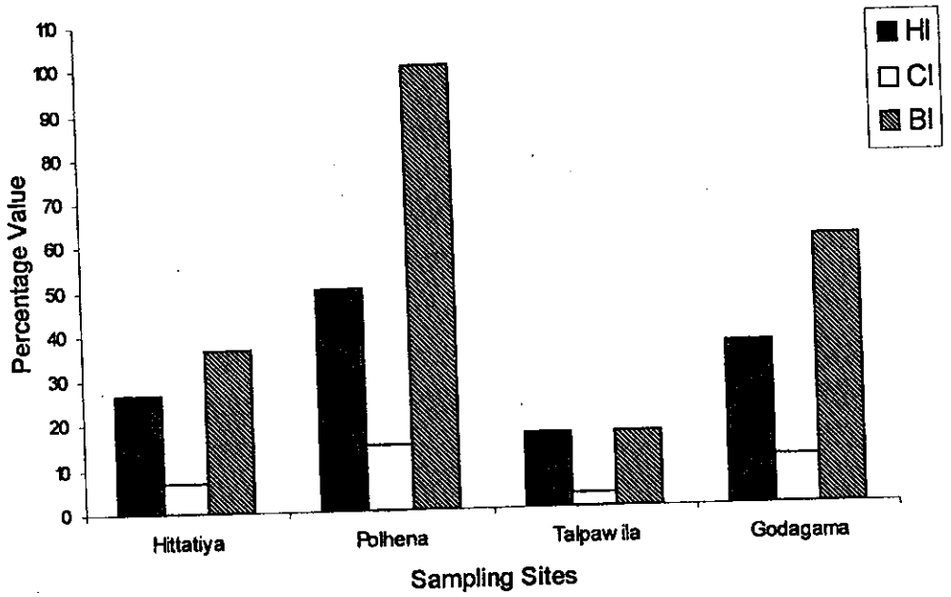

Figure 2 - Larval indices in different sites

By analyzing the data, it is clear that HI, CI and BI vary among the urban and rural sites. However it is essential to conduct long term collection procedure to get the statistically significant result.

Discussion

Mosquitoes interfere seriously with human life by causing nuisance or transmitting many deadly diseases. Inspite of all irradication programmes mosquitoes survive well throughout the world especially due to the anthropogenic activities, which favor their growth and breeding (Dissanaike, 1984).

Sri Lanka is suffering from four important mosquito vector borne diseases namely Malaria, Dengue, Filaria and Japanese Encephalitis. Among these diseases Dengue and Filaria is prevalent in Matara, the selected site for this study.

The study was conducted during the South-West monsoon period which brings the highest rainfall to the study area. At the same time government has conducted awareness programmes on Dengue irradication to the public in the area, as Dengue cases were recorded in some parts of Matara district. Success of this awareness programme was indicated by the reduction of mosquito larvae in later sampling occasions in the study areas.

Larvae of *A. subalbatus, C. quinquefasciatus, A. albopictus* were recorded from all the study sites. HI, CI and BI calculated for these larvae and these indices were higher in urban sites than those for the rural sites. Number of mosquito breeding sites in urban area is higher than that of the rural sites.

C. quinquefasciatus, is the most important vector of *Wuchereria bancrofti* in Sri Lanka. Prolific breeding sites of *C. quinquefasciatus* was observed in Coconut husk pits in Matara relative the coconut husk pits in Panadura, Talalla and Alutgama (Dissanaike, 1991).

Present study also indicates the wide distribution of that particular species across the sampling sites in Matara although they are collected from different habitats. *A. subalbatus* another mosquito species breed well in polluted water, was highly abundant in Hittatiya (urban area) sampling site compared to the Polhena.Their high abundance in Hittatiya compared to the Polhena might be due to several reasons., such as high abundance of *C. quinquefasciatus* may have reduced their abundance in Polhena or environmental factors in Hittatiya is more favorable to *A. subalbatus* than that of the Polhena. These factors need further investigations.

A. albopictus which breed successfully in natural or artificial water containers were abundant in all the study sites. Coconut husk with shells, which is considered as highly productive breeding sites for *A. albopictus* was abundant in all sampling sites.

That might be the reason for the highest abundance in *A. albopictus* in all the study areas.

During this study it was observed that there were more breeding sites for mosquitoes in urban sampling sites relative to the sampling sites in rural areas.

At the beginning of the research HI, CI and BI were higher than the rest of sampling days. Reduction of these indices might be due to the awareness programmes conducted by the government. Although natural condition such as, rainfall was abundant during that period, it was not sufficient enough for the abundance of these mosquitoes. This indicates the importance of suitable breeding habitats, such as natural and man-made containers on the abundance of these mosquito larvae.

The present study indicates that an increase of human population and urbanization will lead to increase the breeding grounds for many mosquito species. One breeding habitat even a small container could provide shelter for more than one species of mosquitoes. Therefore proper awareness and good sanitation practices are the most important factors for the reduction of mosquito breeding ground that leads to prevent diseases transmitted by the above mentioned mosquito species.

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