Full Length Research Article

DIVERSITY ASSESSMENT OF MOSQUITOES WITH REFERENCE TO THE OCCURRENCE OF VECTOR BORNE DISEASES IN THALASSERY MUNICIPAL AREA OF MALABAR COAST, KERALA, INDIA

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ABSTRACT

Repeated outbreaksof vector-borne diseases necessitateddetailed study on the diversity and abundance of mosquitoes associated withThalassery municipal area, of Kannur district, Kerala, India.Seasonal collection of mosquitoes both in adult and larval forms were carried outfrom heterogeneous habitats of the municipal area to determine the species composition, relative abundance and habitat characteristics. Mosquito larvae collected from temporary and permanent breeding sites were reared to adults in the laboratory for species level identification. Similarly adult mosquitoes, collected from random sites were also subjected to species level identification following standard manuals.Species diversity of adult mosquitoes was higher during post monsoon season (2 genera, 5 species) than pre monsoon season (1 genus,2 species). However a reversal in species diversity has been noticed with mosquito larvae, with higher species diversity during premonsoon season (4 genera,8 species) than post monsoon season (4 genera, 6 species).In both the seasons, *Culexquinquefaciatus* and *Anopheles stephensi* were the most predominant species in terms of relative abundance and distribution.The mosquito communities sampled were noted to have several important vectors of infectious diseases such as Dengue, Chikungunya, Filariasis and Malaria, which recalls the urgent need for instituting appropriate measures for controlling these mosquito-borne diseases.

INTRODUCTION

Mosquitoes are the most imperious group of insects, adversely influencing the health status of human beings. They have a worldwide distribution and are involved in the transmission of many dreadful diseases like Chikungunya, Malaria, Dengue fever and Filariasis, affecting millions of people every year. Increasing population density, deteriorating infrastructure, inadequate access to health, water, and sanitation services are contributing to the risk of disease transmission (Macintyre et al., 2002). Climatic conditions and environment play a significant role in the spatial and temporal distribution of vectors, especially mosquitoes (Wanji *et al.,* 2009). They breed in natural or manmade water bodies such as pools, rivers, lakes, tree holes with a variety of oviposition sites (Rattanarithikul *et al.,* 2005). Larval distribution is greatly influenced by several factors such as types of water source, elevation, water movement, water temperature and associated

Vegetation (Rattanarithikul *et al.,* 2005). Oviposition, development of larva, adult emergence and many other processes take place in larval habitats, thus playing an important role in determining adult diversity, distribution and abundance (Overgaard *et al*., 2002). Thalassery municipal area, falling in the coastline of the state of Kerala, is known for repeated occurrence of epidemics. Most of the diseases rampant in the municipal area are mosquito borne and the recent reports of filariasis are last in this category.In order to comprehend the epidemiology of different diseases, inventory on mosquito biodiversity is essential. Such systematic inquiries on the geographic distribution of insect vectors will help to evaluate the transmission risk of vector-borne diseases in a better way. In this context, the present study has been attempted to evaluate the diversity and abundance of mosquito vectors associated with the Thalassery municipal area, with respect to seasons.

MATERIALS AND METHODS

Study area: Thalassery municipalityof Kannur District in the state of Kerala, Indiais half an island lying on the banks of the Eranjoli River and surrounded by the Arabian Sea.Collection

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of both larvae and adult mosquitoes were carried out from 6 heterogeneous habitats of Thalassery municipal area.

Sampling of adult mosquitoes

Adult mosquitoes that were resting indoors, outdoors and moving around and biting men were collected during morning and evening hoursusing oral aspirators and test tubes. The collected specimens were brought to the laboratory for identification and documentation.

Sampling and identification of mosquito larvae

Collection of mosquito larvae and pupae were carried out from heterogeneous water bodies in selected locations with the help of a dipper. The collected larvae / pupae were brought to the laboratory for rearing, followed by species level identification. For rearing, water samples containing larvae / pupae from each site were transferred to plastic jars. All the jars were covered with net of small mesh size to avoid escape of adult mosquitoes. A lid was maintained in the net for collection of adult mosquitoes from the jars. No artificial food was given to the larvae as the water samples from the respective sites were enriched with nutrients. Emerging adult mosquitoes were collected with the help of a manual aspirator and killed with cotton swab of ethyl acetate. Species level identification of mosquitoes, both adults and larvae, collected during premonsoon and post monsoon seasons was done using Taxonomic keys provided in "The fauna of British India, including Ceylon and Burma" by Christophers (1933) and Barraud (1934).

The seasonal variation in mosquitoes was analysed in terms of relative abundance and distribution (Rydzanicz and Lonc, 2003; Sengil *et al.,* 2011). The mosquito species were also classified in the following relative abundance classes ie. Satellite species (relative abundance <1%), Sub-dominant species (relative abundance <5%) and dominant species (relative abundance >5%) following Trojan (1992).The following classes were used to represent the distribution status of different species as C1 (sporadic: 0-20%); C2 (infrequent: 20.1-40%); C3 (moderate: 40.1-60%); C4 (frequent: 60.1-80%; and C5 (constant: 80.1- 100%), following Dzieczkowski (1972). Percentage densities of different genera in all the sampling sites during both the seasons were also analysed and reported.

RESULTS AND DISCUSSION

Mosquitoes are well known group of insects, which transmit many dreadful diseases causing serious health problems to human beings. Climate change and variability are highly likely to influence the biology and ecology of mosquito vectors and consequently the risk of disease transmission.Thalassery municipal area is known to be endemic towards many mosquito borne diseases especially filariasis. There is no published information regarding species composition of mosquitoes confining toThalassery municipal area of Kannur district, Kerala. With the aim of contributing to this knowledge, the present study has been taken up. Attempts were carried out to assess the diversity, abundance and distribution of mosquitoes confining to the area during pre monsoon and post monsoon seasons.
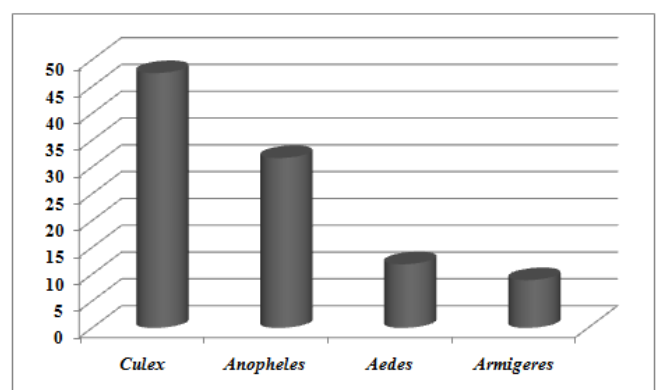
Premonsoon collection

Diversity studies on the adult mosquitoes revealed a total of 2 species belonging to 1 genus (*Culex*) whereas mosquitoes reared from larvae comprised of 8 species belonging to 4 genera (*Culex, Anopheles, Aedes* and *Armigeres*). The larval collection showed a higher density and species diversitythan the post monsoonal larval collection. Relative abundance and distribution status of the total mosquito species collected in the Premonsoon season were calculated (**Table 1**).In terms of relative abundance and distribution, *Aedes aegypti, Anopheles stephensi and Culexquinquefaciatus* were the most predominant species.

Table 1. Relative abundance and distribution status of mosquito species in the Premonsoon season

Species	Rel. abun.(%)	Rel. abun. status	Distribution (%)	Distribution status
Aedes aegypti	11.88	Dominant	33.33	Infrequent
Anopheles stephensi	31.19	Dominant	83.33	Constant
Anopheles subpictus	3.96	Subdominant	16.67	Sporadic
Anopheles vagus	4.46	Subdominant	16.67	Sporadic
Armigeres annulipalpis	8.91	Dominant	33.33	Infrequent
Culex gelidus	1.98	Subdominant	16.67	Sporadic
Culex quinquefaciatus	28.71	Dominant	83.33	Constant
Culex sitiens	8.91	Dominant	16.67	Sporadic

Percentage densities of the four genera (*Culex, Anopheles, Aedes* and *Armigeres*) in all the sampling sites (**Figure 1**) revealed that *Culex* were the predominant group (**47.52%**) followed by *Anopheles* (**31.68%**). Occurrence of both *Aedes* (**11.88%**) and *Armigeres* (**8.91%**) were rare during the period of study.

Figure 1. Percentage densities of different genera in all the sampling sites during Premonsoon season

Post monsoon collection

Data on the post monsoonal adult collection showed a higher number with respect to species diversity (5 species belonging to 2 genera, *Culex* and *Aedes*) and abundance. Larval collection revealed 6 species belonging to 4 genera. Relative abundance and distribution status of the total mosquito species collected in the post monsoon season were calculated (Table 2).

Table 2. Relative abundance and distribution status of mosquito species in the Postmonsoon season

Species	Rel. abun (%)	Rel. abun. status	Distribution (%)	Distribution status
Aedes aegypti	8.24	Subdominant	33.33	Infrequent
Aedes vittatus	3.53	Subdominant	16.67	Sporadic
Anopheles stephensi	18.82	Dominant	50	Moderate
Armigeres annulipalpis	10.00	Dominant	16.67	Sporadic
Culex epidesmus	4.12	Satellite	16.67	Sporadic
Culex fuscocephala	2.35	Satellite	16.67	Sporadic
Culex quinquefaciatus	32.35	Dominant	66.67	Frequent
Culex sitiens	18.24	Dominant	33.33	Infrequent
Culex vishnui	2.35	Satellite	16.67	Sporadic

In terms of relative abundance and distribution, *Anopheles stephensi Culexquinquefaciatus* and *Culex sitiens* were the most predominant species.The four genera of mosquitoes reported from all the sampling sites during Post monsoon season were *Culex, Anopheles, Aedes* and *Armigeres*. Data on their percentage densities were 59.41%, 18.82%, 11.76% and 10.00% respectively (Figure 2).
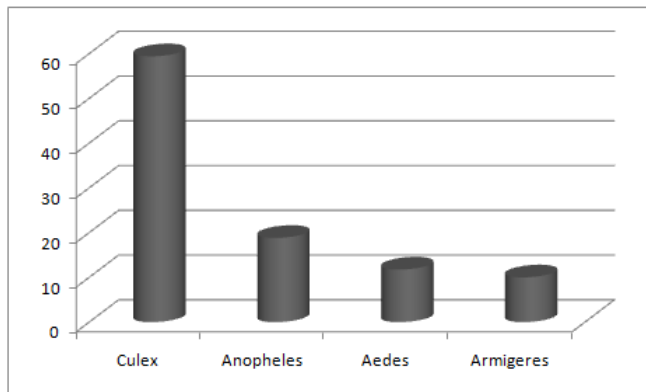
Figure 2. Percentage densities of different genera in all the sampling sites during Post monsoon season

On an overall assessment, it has been noticed that the larval density as well as the abundance of mosquitoes were maximum during premonsoon collection where as the diversity was maximum in the post monsoonal collection. In both the seasonal collections, *Culex* was the most predominant genus in terms of relative abundance, distribution and diversity. Mosquito fauna of the area during various seasons of the year was well understood and reported. The mosquito communities sampled included several important vectors of infectious diseases such as Dengue, Chikungunya, Malaria and Filariasis. In both the seasons *Culexquinquefaciatus* and *Anopheles stephensi* were the most predominant species in terms of relative abundance and distribution. *Culexquinquefaciatus*, the filarial vector was sampled from almost all the habitats. The present datathus implies the exigent need for instituting appropriate measures for controlling these vectors and safeguarding populations at risk of mosquito-borne diseases.

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