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RESEARCH ARTICLE

MOSQUITO VECTORS OF IRINJALAKUDA, THRISSUR

Lakshmi, K. V., Thasia Chandran and *Aneesh E. M.

Department of Zoology, St. Joseph's College, Irinjalakuda, Thrissur, India

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ABSTRACT

Aim of this study was to determine the presence of potential mosquito vectors in the Irinjalakuda Municipality. Urban and semi-urban characteristics of Irinjalakuda municipality provide suitable breeding habitats for different species of mosquito vectors. Mosquito larvae were collected from 25 selected sites of the study area from July 2012 to June 2013. A total of 30 species belonging to 5 genera, *Anopheles, Aedes, Culex, Mansonia* and *Armigeres* were collected and identified using systematic keys. The vectorial capacity of these mosquito species was discussed.

INTRODUCTION

Vector is an organism that transmits a disease or parasite from one living organism to another. Mosquitoes are considered as one of the most relevant group of arthropods as they can act as vectors for various diseases such as Malaria, Filariasis, Japanese Encepalitis (JE), Dengue fever, chikungunya etc.Mosquites surveillance is a prerequisite for an effective and efficient mosquito control program. (Santos *et al.*, 2002).Mosquitoes belonging to the Genera *Culex, Aedes, Anopheles, Mansonia* and *Armigeres* are the major vectors seen in Kerala. Malaria is a parasitic disease transmitted mainly by *Anopheles* mosquitoes. Among these pathogens of malaria, *Plasmodium falciparum* and *Plasmodium vivax* are the most common with *P. falciparum* being most deadly (WHO 2013). Lymphatic filariasis is caused by infection with nematodes of the family Filariodidea of which *Wuchereria bancrofti* is responsible for 90% of the cases and the rest is caused by *Brugia malayi* and *B. timori*. *Culex, Anopheles* and *Aedes* mosquitoes are known vectors this disease. Japanese encephalitis, caused by Japanese Encephalitis Virus, a flavivirus belonging to arthropod-borne virus family is transmitted through *Culex* mosquito (Thenmozhi *et al.,* 2013). The Dengue virus belongs to the flaviviridae family, genus Flavivirus, and it has four distinct antigenic steriotypes (DEN-1,DEN-2,DEN-3and DEN-4) that causes classic Dengue fever (DF) and Dengue Haemorrhagic Fever(DHF) (Miagostovich *et al*., 2004). Dengue viruses are maintained in a human-mosquito- human cycle with *Aedes aegypti* serving as the principle vector (Anderson and Rico-Hesse., 2006).

***Corresponding author:** Aneesh E. M*
Department of Zoology, St. Joseph's College, Irinjalakuda, Thrissur, India.

Chikungunya disease is a mosquito-borne viral infection caused by single-stranded RNA Alpha Virus from the family Togaviridae (Nagpal *et al.*, 2012). Rift Valley Fever (RVF) is a zoonotic disease of domestic ruminants and humans caused by an arbovirus belonging to the *Phlebovirus* genus (Family: Bunyaviridae). In its epidemiological cycle, humans are the dead-end host. (Chevalier *et al.*, 2010). The Yellow Fever Virus is an arbovirus of the *Flavivirus* genus and mosquito is the primary vector which carries pathogen between monkeys, from monkeys to human and from person to person (WHO, 2013). As per WHO, in 2011 a total number of 68,000 clinical cases of JE was recorded worldwide. Nearly 1.4 billion people in 73 countries worldwide are threatened by lymphatic filariasis. Over 120 million people are currently infected, with about 40 million disfigured and incapacitated by the disease. In the case of Malaria there were about 207 million cases in 2012 and an estimated 627000 deaths. Over 2.5 billion people over 40% of the world population are now at risk from Dengue. Chikungunya has been identified in nearly 40 countries in Asia, Africa, and Europe and also in the Americas.

These increasing mosquito-borne diseases are the major challenge in the field of public health of Kerala. Understanding the vectors of these diseases will aid better prevention and control.

MATERIALS AND METHODS

Study Area

Irinjalakuda is a municipal town in Thrissur district of Kerala, India (10.33˚ N 76.23˚E) is an important cultural, educational and commercial centre. Twenty five different spots were

randomly selected with an intention to cover entire topography of the district.

Sampling Methods

Different methods were employed to collect the mosquitoes during the survey. Larvae were collected from 25 selected sites using dippers (12cm diameter and of 300 ml capacity), aquatic nets and glass pipette (Service, 1976). These were then transferred to plastic vials for their transportation to the laboratory. All the spots were visited periodically. Collected larvae were categorized in the laboratory. The collected larvae were identified with a key of Barraud (1934) and Christophers (1933), catalogue of stone and Knight (1959 and Rao (1981).

RESULTS AND DISCUSSION

During the study period mosquitoes belonging to 5 genera and 30 species were collected and identified. The identified genera include *Aedes, Anopheles, Mansonia, Armigeres,* and *Culex*. Of the collected mosquitoes, *Culex* was the predominant genus with maximum of 12 species followed by *Aedes* with 7 species, *Anopheles* with 6 species, *Mansonia* with 3 species and *Armigeres* which was represented by only one species. Majority of the collected species are potential vectors of various diseases. Of the colleted 30 species 25 were incriminated vectors. A total of 12 species of *Culex* larvae were collected of which 4 species are commom vectors of Japanese encephalitis. *Cx. gelidus, Cx. tritaeniorynchus, Cx. Vishnui and Cx. pseudovishnui* are implicated as major vectors of JE in India (Samuel *et al*, 2000). In Kerala *Cx. tritaniorynchus* is considered as the major vector of JE due to its high abundance and frequent JE virus infection (Arunachalam *et al.*, 2004). *Cx. quinquefasciatus* is a primary vector of *Wuchereria bancrofti* in urban areas of Afrotropical and South East Asian Regions, the Western Pacific and of the American continents (Vinogradova., 2000) which causes filariasis. *Cx. bitaeniorhynchus* is also a vector of Lymphatic Filariasis, Murray valley encephalitis and Batai virus. *Cx. univittatus* is a vector of West Nile Virus. *Bancroftian* and *Malayan* filariasis parasites are transmitted by *Cx. gelidus* (WRBU) were also

Table 1. Reported Cases of Mosquito-Borne Disease Outbreak in Thrissur District, Kerala

S.No.	Disease	2006		2007		2008		2009		2010		2011		2012		2013	
		C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D
1	Chikungunya	0	0	48	0	11	0	29	0	23	0	5	0	1	0	0	0
2	JE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0
3	Dengue	72	0	89	0	10	0	152	0	74	0	28	0	173	0	181	0
4	Malaria	222	0	160	0	193	0	167	0	219	1	172	0	194	1	96	0

C- Number of Cases Reported, D-Number of Death Occurred

Table 2. Systematic List of Mosquito Species collected and identified from Irinjalakuda and Their Vectorial Status

S. No.	GENERA	SPECIES	VECTORIAL STATUS
1	*Anopheles*	*stephensi*	Malaria
		barbirostris	Malaria
		culicifacies	Malaria
		subpictus	Malaria, Filariasis
		vagus	Malaria
		nigerrimus	Malaria
2	*Mansonia*	*crassipes*	Malaria, Bird filaroid, Human filariasis
		uniformis	Filariasis, Japanese encephalitis
		indiana	Lymphatic filariasis
3	*Aedes*	*scatophagoides*	
		pseudotoeniatus	
		longirostris	
		aegypti	West Nile virus, Dengue, Yellow fever, Chikungunya
		vittatus	Chikungunya
		albopictus	WNV, Dengue
		walbus	
		vexanus	Rift Valley Fever Virus, WNV
4	*Armigeres*	*subalbatus*	Filariasis
5	*Culex*	*fascanus*	JE
		quinquefasciatus	Filariasis, JE
		gelidus	JE, Ross River Virus, Bancroftian and Malayan filariasis
		univittatus	WNV
		fuscocephala	JE
		tritaenorhynchus	JE
		whitmorei	JE
		vishnui	JE
		sinensis	
		bitaeniorhynchus	JE, lymphatic filariasis, bancrofti filariasis, Murray Valley encephalitis, Batai virus
		infula	JE
		pseudovishnui	JE

Table 3. Number of incriminated vectores collected from each genera

S. No.	Genus	Je	Malaria	Filariasis	Chikungunya	Dengue	WNV	Other
1	*Culex*	10		3			1	3
2	*Aedes*				2	2	3	2
3	*Anopheles*		6	1				
4	*Mansonia*	1	1	3				1
5	*Armigeres*		1					

collected from the study area. Among the 8 collected species of *Aedes* mosquitoes only 4 species were known to have vector status. These species include *Aedes aegypti*, *Ae. albopictus*, *Ae. vittatus* and *Ae. vexanus*. *Ae. aegypti* is the primary vector of Dengue and Chikungunya. *Ae. albopictus* is the secondary vector of Dengue and transmit Chikungunya in Asia, Africa and Europe and also transmit WNV (WHO, 2013). All the *Anopheles* species collected in the present study are incriminated vectors of malaria. *Anopheles stephensi* and *Anopheles culicifacies* are the primary vectors of malaria in urban and rural areas respectively (Nagpal and Sharma., 1995). *An. culicifacies* is a major vector of malaria (Dash *et al*., 2007) while *An. subpictus* is a significant secondary vector (Amerasinghe *et al*., 1999). *An. subpictus* is also known to transmit filariasis (Elango *et al*., 2011). *An. barbirostris*, *An. vagus* and *An. nigerrimus* are positive for *P. falciparum* isolation test (Alam., 2010). The captured *Mansonia* species include *M.indiana*, *M.uniformis* and *M. crassipes* in which *M.uniformis* is a known vector of filariasis (Ughasi *et al*., 2012) and JE (Kanojia *et al*., 2002). *M.indiana* is a vecor of *W.malayi*, a causative nematode of lymphatic filariasis(WRBU). *M. crassipes* appears to be the principle vector of *Cardiofilaria nilesi* and *Pelecitus* sp. (Niles., 1966). Genus *Armigeres* was represented only by one species, *Armigeres subalbatus* which has been known to be a vector of JE Virus (liu *et al*., 2013) and it has also been reported to be a vector of *W. bancrofti* in India (Das *et al*., 1983).

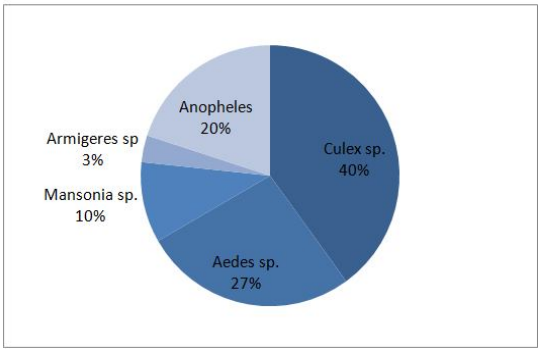

Figure 1. Mosquito Species Composition of Study Area

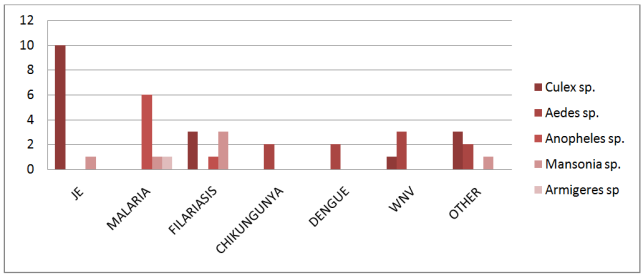

Figure 2. Vectorial Capacity of Collected species

In this preliminary study vector diversity of Irinjalakuda Muncipality was high with 83% of total possible vector species. During the study period, presence of possible vector species of JE, was predominant followed by malarial, filariasis, WNV, Chikungunya and Dengue. Primary vectors of all these diseases were recorded. Further studies on their abundance will help in predicting any possible mosquito borne disease outbreak and their effective control. The result of this study indicates that effective vector control should be undertaken to prevent mosquito-borne disease outbreaks in this area.

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