

# Distribution study of tree hole mosquitoes (Diptera : Culicidae) during pre-and post-monsoon seasons in kolli hills of Eastern Ghats, Tamilnadu

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## Abstract

The biodiversity and their relative abundance of tree hole breeding mosquitoes occurring in four localities (Anankadu, Solakkadu, Nigayanallur and Pallakkuli) of Kolli hills in Eastern Ghats, Tamilnadu, India, were studied between Premonsoon (May-June 2013) and Post monsoon (November-December 2013) period. Six species of mosquitoes belonged to 4 genera namely *Aedes aegypti, A. albopictus, Culex uniformis, Orthopodomyia anopheloides, Toxorhynchites viridibasis,* and *T. rutilus* were found to breed in tree holes frequently. The collected samples were studied by Simpson Index 'D'(0.2073, 0.1753) and Brillouin Index 'HB'(1.5486, 1.6186). It is concluded that the tree hole breeding mosquitoes in Kolli hills could act as vectors for the possible outbreak of mosquito borne disease.

Key words: Kolli hills, Pre-monsoon, Post-monsoon, Diversity, Mosquitoes.

## INTRODUCTION

Studies on taxonomy, biology, distribution and ecology of haematophagous arthropods are public importance. General reviews on the ecology and control of individual vector groups should be continued and reviewed from time to time (Ravikumar et al., 2013). It has been assumed that the mosquitoes are the vectors of dengue, filariasis, malaria, chickungunya, DHF, WNV, etc. They are usually breed in containers, chesspits, drain, septic tanks, pond, cesspool, etc. (Senthamarai Selvan, 2014a). Some species of mosquito are breed in tree holes (Makesh Kumar et al., 2014). The foothills of the Eastern Ghats were once hyperendemic for dengue. These hill ranges have an extremely rich flora and fauna. In India only 6 anophelines species viz., A. culiciformis, A. barianensis, A. asiaticus, A. annandalei, A. annandalei var.djajasanensis and A. sintoni were known to breed in tree holes (Iyengar, 1929; Puri, 1931; Rao, 1970). The mosquito genera of Aedes, Armigeres, Culex, Ficalbia, Harpagomyia, Herzamannia, Orthopodomiya, Tripteroides, Uranotaenia and Toxorhynchites were also reported to breed in tree holes in India (Barraud, 1934; Christopheres, 1960; Panicker and Rajagopalan, 1978).

Most of the studies on mosquito in India have been done in relation to the geographic location (Dutta*et al.*, 2010). Mosquitoes are haematophagous insects in terms of public health significance and they are remarkably adapted to coexist with man and domestic animals (Wegner, 2009). Increasing population, unplanned organization, rapid transportation, unreliable water supplies and water storage practices of people are the cause of the rapid spread of mosquito species (Ravikumar *et al.*, 2013). Mosquito survey provides valuable information on occurrence, distribution, prevalence and species composition of various mosquitoes in an area (John Wilson *et al.*, 2013). Field research on tree hole mosquito biology and ecology has been aimed towards a better understanding of favourable larval habitats preference in various tree species.

#### MATERIALS AND METHODS

#### **Study Sites**

The Kolli hills/Kollimalai (Figure 1) is situated in Namakkal district, Tamilnadu, India (78° 20' 0'' E to 78° 30' 0'' E and 11° 10' 0'' N to 11° 20'0'' N). They are low ranging hills spread over an area of 441.41 km<sup>2</sup>. The study was carried out in domestic premises and forest areas of the Kolli hills of Eastern Ghats including Anankadu, Solakkadu, Nigayanallur and Pallakkuli during pre-monsoon and post monsoon seasons. Diversity survey was carried out in May-June 2013 (Premonsoon) and November-December 2013 (Postmonsoon).

#### **Specimen Collection**

Random collection of larvae, pupae and adult mosquitoes were made from water in different tree holes. Trees were selected on the basis of the availability of tree holes (Senthamarai Selvan, 2014b). Samples representing immature stages of mosquito species were collected in plastic containers (500ml capacity) with the help of kerosene pump and transported to the laboratory.

#### **Preservation and Indentification**

Transported immature samples were allowed to develop into adults, which were killed with chloroform soaked cotton swabs and microscopic identification up to species level with the help of mosquito identification keys (Barraud, 1934; Jebanesan *et al.*, 2012). The voucher specimens are present in the department of Zoology, Annamalai University, Chidambaram.

## **Statistical Analysis**

Mosquito samples were analyzed quantitatively to determine the diversity of mosquitoes by Simpson's Index 'D' and Brillouin Index 'HB'.

The Simpson index was used for calculating the diversity value.

Simpson's Index ( $\lambda$ ) = 1 /  $\Sigma$  (Pi<sup>2</sup>)

where,  $\lambda = \text{Simpson's index}$ ,

Pi = Frequency of species.

The Brillouin index is more sensitive to species abundance calculated by

 $HB = In (N!) - \Sigma In (n!) N$ 

where,

HB = Brillouin Index,

N- is the total number of individuals in the sample,

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**Table-1:** Genera and Number of tree hole mosquito species recorded from Kolli hills, Eastern Ghats, Tamilnadu, India

Genus	Pre-Monsoon	Post-Monsoon	Total	
Aedes aegypti	33	23	56	
A. albopictus	23	14	37	
Culex uuniform	is 15	16	31	
Orthopodomyia				
anopheloides	7	9	16	
Toxorhynchites				
viridibasis	8	10	18	
Toxo. rutilus	14	12	26	
Total	100	84	184	

**Table-3:** Statistical results of tree hole mosquitoes in selected areas of Kolli hills.

Name of the Index	Pre-Monsoon	Post-Monson
Simpson Index 'D'	0.2073	0.1753
Brillouin Index 'HB'	1.5486	1.6186

Table-2: Distribution of tree hole mosquito species recorded from selected localities in Kolli hills, Eastern Ghats, Tamilnadu, India

Locality	Name of the Species	Pre-Monsoon			Post-Monsoon		
		Larva	Adult	Total	Larva	Adult	Total
Locality-1	Aedes aegypti	3	2	5	2	1	3
Anankadu	A. albopictus	1	4	5	1	-	1
	Culex uniformis	6	-	6	2	3	5
	Orthopodomyia anopheloides	-	1	1	1	1	2
	Toxorhynchites viridibasis	-	2	2	2	1	3
	Toxorhynchites rutilus	1	1	2	0	1	1
Locality-2	Aedes aegypti	2	1	3	5	2	7
Solakkadu	A. albopictus	-	3	3	2	-	2
	Culex uniformis	-	1	1	5	1	6
	Orthopodomyia anopheloides	1	-	1	2	1	3
	Toxorhynchites viridibasis	3	-	3	3	-	3
	Toxorhynchites rutilus	2	1	3	1	3	4
Locality-3	Aedes aegypti	11	6	17	6	-	6
Nigayanallur	A. albopictus	9	3	12	3	4	7
	Culexuniformis	4	2	6	3	1	4
	Orthopodomyia anopheloides	1	-	1	-	2	2
	Toxorhynchites viridibasis	-	1	1	3	-	3
	Toxorhynchites rutilus	3	2	5	4	1	5
Locality-4	Aedes aegypti	3	5	8	5	2	7
Pallakkuli	A. albopictus	2	1	3	3	1	4
	Culexuniformis	1	1	2	-	1	1
	Orthopodomyia anopheloides	3	1	4	1	1	2
	Toxorhynchites viridibasis	2	-	2	1	-	1
	Toxorhynchites rutilus	3	1	4	-	2	2

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Figure-1: Study areas in Kolli hills, Eastern Ghats of Tamilnadu, India.

Ni-is the number of individual of species i, In (x)- refers to natural logarithm of x.

#### **RESULTS AND DISCUSSION**

Mosquito surveys were conducted during pre-monsoon and post-monsoon seasons in the selected localities of Kolli hills, Eastern Ghats, Tamilnadu, India. A total of 184 mosquito species were collected from water in different tree holes. They belonged to four genera and the collected larvae were reared in the laboratory up to adult stage. The diversity of mosquito fauna differed among these hills areas, indicating the existence of variation in the diversity and distribution in relation to altitude and specific ecological condition of the selected study localities in Kolli hills. The number of mosquitoes recorded was higher (n=100) during pre-monsoon than post-monsoon (n=84). In total, A. aegypti (n=56) was dominant followed by A. albopictus(n=37) and the least species was Orthopodomyia anopheloides (n=16). The study areas are covered with vegetation dominated by Delonix rigia, Kigelia pinnata, etc., and the trees had sufficient holes to enhance mosquito breeding.

Based on the analysis of Simpson diversity index ( $\lambda$ ), a comparison of  $\lambda$  biodiversity index revealed that the most diverse values are indicated in the pre-monsoon ( $\lambda$ =0.2073) followed by post-monsoon ( $\lambda$ =0.1753) and the Brillouin Index values HB = 1.5486, and HB = 1.6186 are represented in the pre-monsoon and post-monsoon period respectively. Spatial distribution of species varied with season. Most of the species showed maximum distribution during pre-monsoon, followed by post-monsoon (Table:3). *A. aegypti* was the widely distributed species. Average number of localities positive for *A. aegypti* were recorded during pre-monsoon and post-monsoon.

Besides the species-area relationship, the distributionabundance relationship has received attention in ecological studies (Gaston *et al.*, 2000). Present study demonstrated the seasonality of mosquitoes. The combined mosquito populations gradually build up during pre-monsoon, reached its maximum during premonsoon and declined to a low level at post-monsoon. The pattern of rainfall and agriculture may affect larval habitats and vector population size (Arunachalam *et al.*, 2004; Kelly *et al.*, 2004). During the dry season limited rainfall also creates new habitats, when water in the rivers is drawn into pools, providing the perfect breeding sites for a number of mosquito species and thus favouring diseases transmission (Gubler *et al.*, 2001). In conclusion, occurrence of dengue vector *A. aegypti* and *A. albopictus*in both during pre and postmonsoon seasons at different altitudes of Kolli hills may cause the outbreak of dengue fever at higher altitudes

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