

# DIVERSITY STUDIES OF MOSQUITOES IN PUSHPAGIRI WILDLIFE SANCTUARY, WESTERN GHATS, INDIA

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## ABSTRACT

To document the diversity of mosquito species in a Pushpagiri Wildlife Sanctuary. One year long study was conducted for first time. Survey in fluctuation of mosquitoes was carried out from June 2016 to May 2017 during monsoon (June to September), post-monsoon (October-January) and summer seasons (February-May). Both larvae and adult mosquitoes were collected with the help of a dipper from heterogeneous water bodies in more than 20 localities of the wildlife sanctuary. Identification of the mosquitoes will be made by using standard taxonomic keys. A Total of 25 species of mosquitoes belonging to 6 genera were recorded. Out of these, genera *Culex* were dominant with (10 species) followed by *Anopheles* (07 species), *Aedes* (04 species), *Ochlerotatus* (03 species), *Armegeres* and *Uranotaenia* (01 each species) were recorded. Continuation and adoption of strict conservation strategies for forest biome in this region is very essential in order to safeguard the rich genetic diversity.

**Key words:** Diversity, Forest Biome, Larva, Mosquitoes, Wildlife Sanctuary

## INTRODUCTION

Mosquitoes, belonging to family Culicidae and order Diptera, are a large group of insects have a worldwide distribution occurring throughout the tropical and temperate regions (Service, 1996). And even beyond the Arctic Circle of the world (Harbach, 2007). The Oriental Region, which includes India, is regarded as one of the richest biogeographic regions for mosquitoes of the world, along with the Neotropics (Gaston and Hudson 1994). Besides their widespread distribution, mosquitoes are notable for the diversity of their habitat. At present, a total of 3,540 recognized mosquito species, divided between two subfamilies and 112 genera, are recorded in the world (Harbach, 2014). The most mosquito species-rich countries and their number of species were Brazil (447), Indonesia (439), Malaysia (415), Thailand (379), Philippines (294), Panama (264), Colombia (251), Democratic Republic of the Congo (248), China (238) and Venezuela (238). Published studies revealed that the Indian mosquito fauna comprises more than 404 species in 49 genera and 41 subgenera. A total of 31 species are currently recognized in India for transmitting various mosquito-borne

agents of human diseases. However, the precise number of mosquito species is not clearly known since new species are being included to the checklist more often in the recent years. The Western Ghats of India is one of the 34 biodiversity hotspots in the world (Myers *et al.*, 2000). Surveys on mosquitoes diversity are usually limited to only certain parts of the Western Ghats (Mishra *et al.*, 1984; Tewari *et al.*, 1987; Ninge Gowda and Vijayan 1992; Geeverghese *et al.*, 1994; Urmila *et al.*, 1999; Gokale *et al.*, 2000; Sathish Kumar *et al.*, 2004; Sathish Kumar and Vijayan 2005; Fakoorziba *et al.*, 2006; Bhuyan *et al.*, 2013; Selvan *et al.*, 2015; Sajith *et al.*, 2016). There are no studies carried out on mosquitoes diversity of Pushpagiri Wildlife Sanctuary. Hence an attempt was made to fill the lacuna through the Investigations on the diversity and abundance of mosquitoes at the Sanctuary.

## MATERIALS AND METHODS

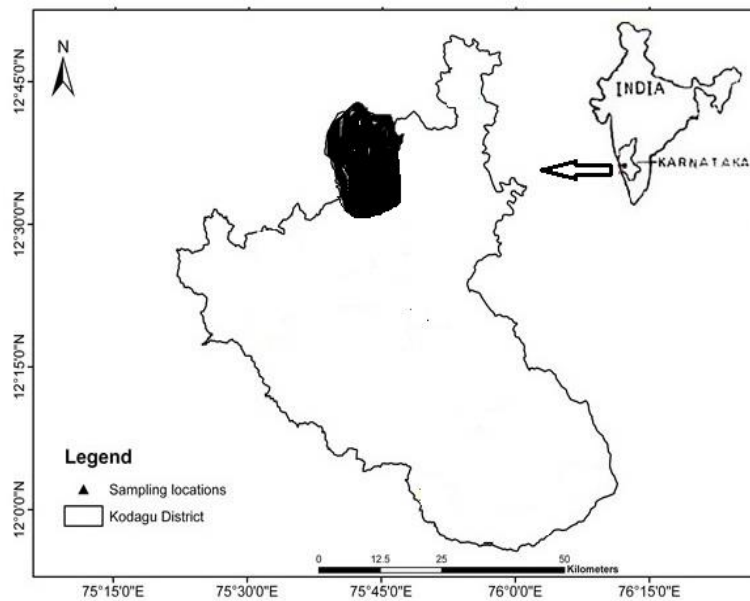
### Study area,

Pushpagiri Wildlife Sanctuary (12°25' N to 12°35' N Latitude; 75°25' E to 75°45' E) is situated on the northwest boundary of the Kodagu district, Central Western Ghats, Karnataka State. The sanctuary spread over an area of 102.92 sq. Km and present at 1712m above sea level. Temperature in the region varies from 10°C during winter 34° C during summer. Annual rainfall ranges between 6000mm -7000mm. Sanctuary has dense evergreen, semi evergreen, shola and grasslands, characteristic of higher altitudes of the Western Ghats. Survey in fluctuation of mosquitoes was carried out from June 2016 to May 2017 during monsoon (June to September), post-monsoon (October-January) and summer seasons (February-May). Both larvae and adult mosquitoes were collected with the help of a dipper from heterogeneous water bodies in more than 20 localities of the wildlife sanctuary (**Fig. 1**). The collected larvae and pupae were brought to the laboratory for rearing, water samples containing larvae and 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. Artificial food was given to the larvae (yeast and dog biscuits in 3:1 ratio). Third and fourth instars were identified under hand lens or microscope in living condition. If the larvae were very active during identification they were taken in a tube and applied little chloroform vapor and then it was placed in slide. Pupae allowed to develop as adult and then identified by using standard taxonomic keys of (Christophers, 1933; Barraud, 1934; Ramachandra Rao, 1974; Reinert, 1974; Sirivanakaran, 1976 and Huang, 1979), the voucher specimens are deposited in Department of Zoology, Field Marshal K.M. Cariappa College, Madikeri, Karnataka, India.

**Table : 1 Relative abundance of mosquitoes at Pushpagiri Wildlife Sanctuary**

Sl No.	Genera	No. of Species	Relative abundance (%)
1	<i>Aedes</i>	04	16
2	<i>Anopheles</i>	07	28
3	<i>Armegeres</i>	01	04
4	<i>Culex</i>	09	36
5	<i>Ochlerotatus</i>	03	12
6	<i>Uranotaenia</i>	01	04

**Fig: 1 Map showing Sampling location Pushpagiri Wildlife Sanctuary**



**Table 2: Seasonal variation, distribution, diversity and abundance of mosquitoes fauna at Pushpagiri Wildlife Sanctuary, Western Ghats**

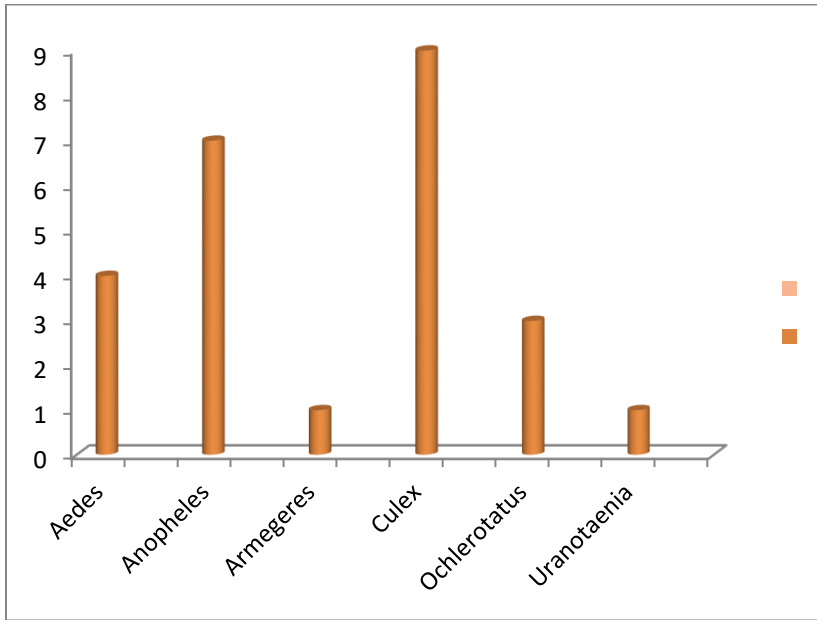
Sl.No	Scientific Name	Monsoon (June to September)	Postmonsoon (October-January)	Summer (February- May)
1	<i>Aedes vittatus</i>	+++	++	+
2	<i>Aedes aegypti</i>	+++++	+++++	+++
3	<i>Aedes albopictus</i>	+++	++	+++
4	<i>Aedes caecus</i>	++	+	+
5	<i>Anopheles barbirostris</i>	+++++	++	-
6	<i>Anopheles annularis</i>	+	+	+
7	<i>Anopheles jamesi</i>	++	+	+
8	<i>Anopheles dirus</i>	+++	++	+++++
9	<i>Anopheles subpictus</i>	+++++	+++	++
10	<i>Anopheles vagus</i>	++	++	+++++
11	<i>Anopheles tessellatus</i>	+++++	+++	++

12	<i>Armigeres flavus</i>	+++	++	-
13	<i>Armigeres magnus</i>	+	-	-
14	<i>Armigeres subalbatus</i>	++	++	++
15	<i>Culex cornutus</i>	-	+	+
16	<i>Culex gelidus</i>	+	-	+
17	<i>Culex mimulus</i>	+++	+++	++
18	<i>Culex infula</i>	++	-	-
19	<i>Culex perplexus</i>	-	+	+
20	<i>Culex whitei</i>	++	++	-
21	<i>Culex foliatus</i>	+	+	-
22	<i>Culex malayi</i>	++++	++++	+++
23	<i>Culex vishnui</i>	++	-	+
24	<i>Ochlerotatus cogilli</i>	++	++	++
25	<i>Uranotaenia campestris</i>	++	+	-

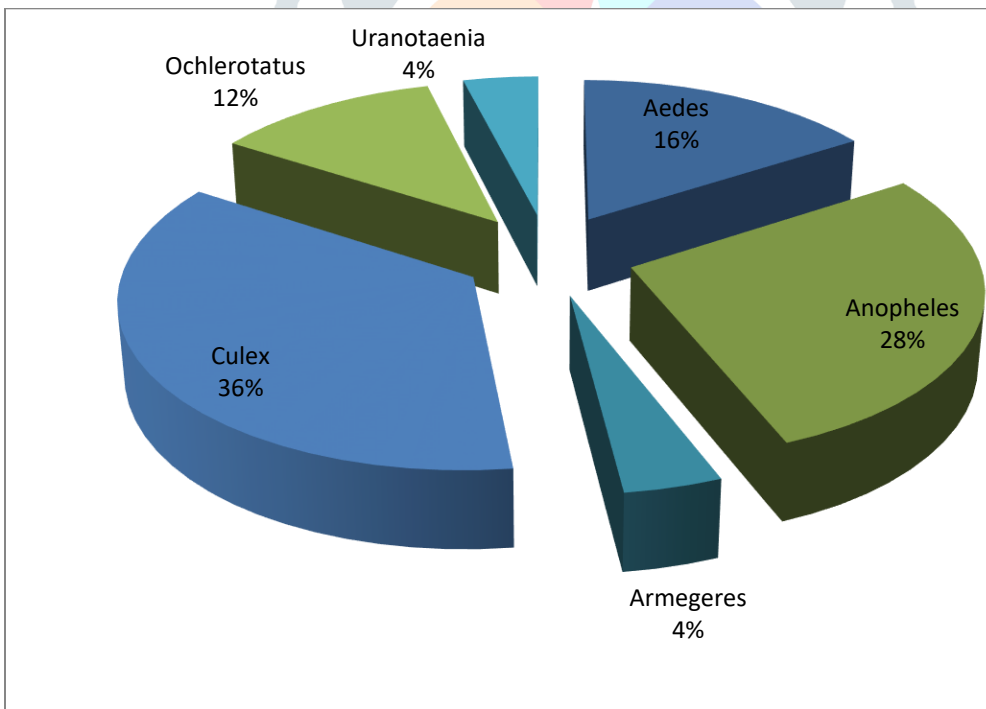
Absent - ; Rare +; Occasional ++; Common +++; Abundant ++++

## RESULTS

A Total of 25 species of mosquitoes belonging to 6 genera were recorded, (**Table-1 & 2**). Out of these, genera *Culex* were dominant with (10 species) followed by *Anopheles* (07 species), *Aedes* (04 species), *Ochlerotatus* (03 species), *Armigeres* and *Uranotaenia* (01 each species) were recorded, (**Fig:2**). The relative abundance of mosquitoes were calculated and presented in (**Table-1**). Among the six genera *Culex* were found to be most dominant members with 36% followed by *Anophele* 28%, *Ochlerotatus* 16%, *Aedes* 12% and less dominant members *Armigeres* and *Uranotaenia* 4% each (**Fig:3**). As per our study *Aedes aegypti*, *Aedes albopictus*, *Anopheles barbirostris*, *Anopheles subpictus*, *Anopheles tessellates*, *Culex mimulus* and *Culex malayi*, are very common species in the study area. *Armigeres magnus* are very rare species in the study area are recorded.



**Fig. 2. Genera wise distribution of mosquito species in Pushpagiri Wildlife Sanctuary**



**Fig. 3. Relative abundance of mosquitoes Genera at Pushpagiri Wildlife Sanctuary**

## DISCUSSION

The present survey provides useful information on the prevalence of larval breeding habitats and association of different species along with seasonal fluctuations of mosquito species in the study area. Climate and physiography are the two well known factors determining the seasonality of majority of mosquitoes (Prakash *et al.*, 1998). In addition water bodies has played an active role in the mosquito prevalence and density (Yadav *et al.*, 1989). Of the 25 species recorded in the present survey 9 species are incriminated vectors of different diseases such as dengue, chickengunya, malaria, filariasis and Japanese encephalitis. Pushpagiri Wildlife Sanctuary has a rich and diversified mosquito fauna represented by 25 species. Among them genus *Culex* was predominant with a maximum number of 10 species followed by *Anopheles* with 7 species and *Aedes* 4 species. *Ochlerotatus* 3 species, *Armegeres* and *Uranotaenia* 1 each species were recorded. Maximum number of species was found in ponds. Most of the *Culex* species were found in ground water habitats. All *ochlerotatus* members were tree hole breeders. *Anopheles vagus*, *Culex vishnui* and *Aedes vittatus* was present in all the ground water bodies as reported earlier by (Malhotra *et al.*, 1987). In India, *Aedes aegypti*, a vector of dengue haemorrhagic fever was a sylvatic species as found in the present survey. Most of the earlier investigators diversity of mosquito prevalence and density in the Western Ghats region in Nilgiri Biosphere (Geeverghese *et al.*, 1994; Sathish Kumar *et al.*, 2004 and Fakoorziba *et al.*, 2006) have reported the more dominance of *Culex* genera our results are corroborating with these findings.

## CONCLUSION

The occurrence of a rich and diversified fauna in some parts of Nilgiri Biosphere where Pushpagiri Wildlife Sanctuary is situated is largely due to the conservation of virgin forest in this region. Continuation and adoption of strict conservation strategies for forest biome in this region is very essential in order to safeguard the rich genetic diversity, since human interference is likely to extend within the region as it is evident at the fringes of the forest area. These results will be useful for integrated vector management in control of epidemics.

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