



ISSN 2320-7078
JEZS 2014; 2 (4): 7-10
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Received: 01-06-2014
Accepted: 17-06-2014

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Diversity of mosquitoes (Diptera: Culicidae) in different habitats of Warangal urban environment

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ABSTRACT

Mosquitoes that inhabit water habitats play an important role in the ecological food chain, and many of them are biters and transmitters of human and animal diseases. Mosquito diversity was studied in three areas of the Warangal Tri city, viz Warangal, Hanamkonda and Kazipet in indoor and outdoor habitats from February 2012 to January 2014. Seven species belonging to 3 genera were collected and identified as *Anopheles culicifacies*, *Anopheles stephensi*, *Anopheles annularis*, *Culex quinquefasciatus*, *Culex tritaeniorhynchus*, *Aedes aegypti* and *Aedes albopictus*. The higher number of mosquitoes were collected outdoors as compared to indoor. The percentage of *Anopheles* mosquitoes at outdoor was (60.80%) followed by *Culex* (60.75%) and *Aedes* (59.33%) and indoor *Anopheles* (39.20%) followed by *Aedes* (40.67%) and *Culex* (39.25%) was recorded during 2012-13. At outdoor *Anopheles* (52.79%) followed by *Culex* (57.22%) and *Aedes* (56.06%) and *Anopheles* (47.21%) followed by *Culex* (42.78%) and *Aedes* (43.94%) was recorded during 2013-2014 in indoor. Shannon and Evenness were calculated.

Keywords: Evenness, Habitats, Mosquitoes, Shannon-Weiner diversity index, Warangal city.

1. Introduction

Mosquitoes are wide spread and diversified group of insects. More than 3500 species of mosquitoes belonging to 42 genera have been recorded under three subfamilies, Anophelinae, Culicinae and Toxorhynchitinae [1]. They are prominent blood suckers that annoying, mammals, birds, reptiles, amphibians and fishes. Owing to their biting, blood feeding habits and ability to transmit pathogens causing fatal diseases including filariasis, malaria, yellow fever, Japanese encephalitis and dengue fever etc. [2]. Biodiversity of mosquitoes is an important aspect of medical science and is destined to emerge as a new significant and integral aspect of human life. Among the insects, mosquitoes are most important since they are related to health and survival of man. The diversity of mosquito species varies among different geographical regions of the world. Mosquito biodiversity has been studied by several workers, [3, 4, 5, 6]. Due to rapid urbanization and industrialization, large numbers of people migrate from rural to urban areas. This leads to the development of slums with no proper sanitary works, poor maintenance and water bodies conducive for the breeding of mosquitoes thus increasing the incidence of vector borne diseases in an urban environment.

The present study was carried out to study the distribution of mosquitoes in different habitats of Warangal urban environment.

2. Material Method

2.1 Study area

The Warangal city is located at 18.0°N 79.58°E. It has an average elevation of 302 meters (990 feet), located in the semi-arid tropical region of Telangana with hot and dry climate. Summers start in March, and peak in May with average 42 °C (108 °F). The monsoon arrives in June and lasts until September with about 550 mm (22 in) of precipitation. A dry, mild winter starts in late November and lasts until early February. The average temperature and humidity was 22–23 °C and 72–73% respectively.

The mosquitoes were collected from human dwelling (indoor) and surrounding of human dwelling (outdoor) using pyrethrum spray method as described by [7, 8] in the morning between 6 am to 8 am and 6 pm to 9 pm. Mosquitoes were collected at outdoor using sucking tube and torch light. All mosquitoes were identified using the key of [3, 9 10].

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Species Shannon-Weiner index:

$[H = -\sum P_i \log P_i]$ and Evenness index $[J=H/H_{max}]$ were worked out.

Species Shannon-Weiner index: $H = -\sum P_i \log P_i$, where

$H =$ Shannon-Weiner index, $P_i = n_i/N$,

$\sum =$ Sum, $n_i =$ Number of individuals of each species in the

sample, $N =$ Total number of individuals of all species in the sample.

Evenness index: $J = H/H_{max}$ Where, $J =$ Evenness index, H is Shannon-Weiner index, $H_{max} = \log S$, 'S' is the number of species.

Different habitats of mosquito species in Warangal urban environment



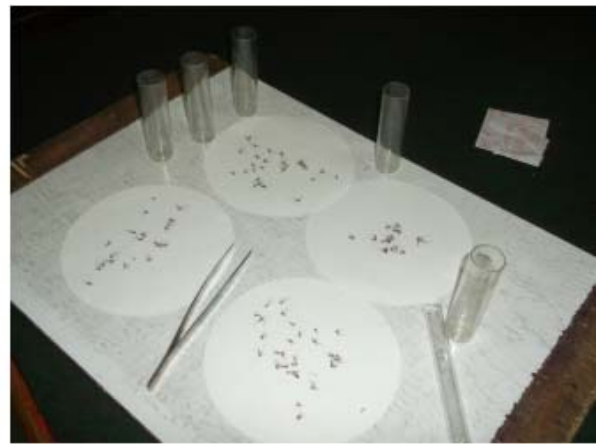
Open type drainage canal



Cattle shed



Collection of mosquitoes in rice field



Collection of mosquitoes in indoor



Construction pit



Tires

3. Results and Discussion

A total of 2440 mosquitoes from outdoor and 1085 mosquitoes from indoor were collected in the urban environment of Warangal. Outdoor and indoor collections revealed seven species of

mosquitoes viz *Anopheles culicifacies*, *Anopheles stephensi*, *Anopheles annularis* in sub family *Anophelinae*, *Culex quinquefasciatus*, *Culex tritaeniorhynchus*, *Aedes aegypti* and *Aedes albopictus* in sub family *Culicinae*. (Table 1).

Table 1: Diversity of mosquitoes in urban environment of Warangal.

Family	Sub family	Species
Culicidae	Anophelinae	<i>Anopheles culicifacies</i>
		<i>Anopheles stephensi</i>
		<i>Anopheles annularis</i>
	Culicinae	<i>Culex quinquefasciatus</i>
		<i>Culex tritaeniorhynchus</i>
		<i>Aedes aegypti</i>
		<i>Aedes albopictus</i>

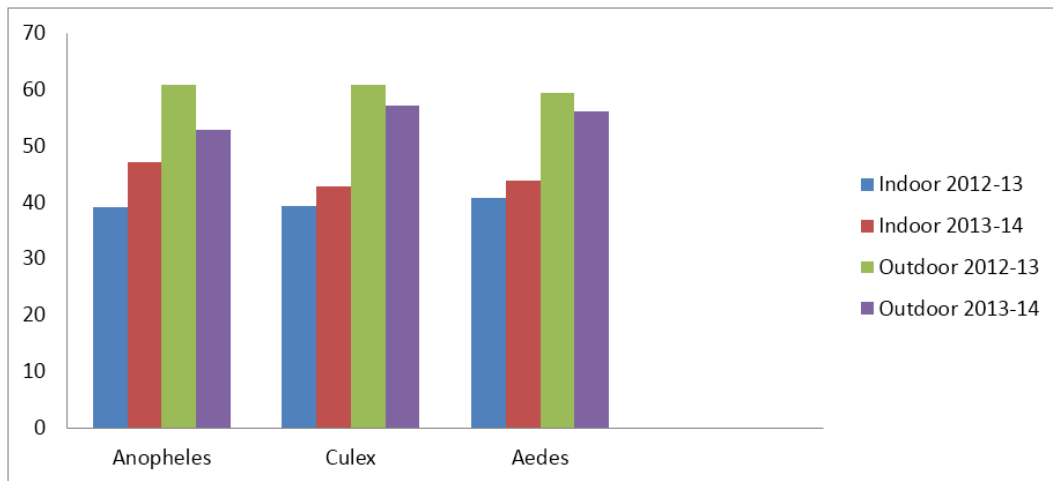


Fig 1: Percentage of mosquitoes in indoor and outdoor habitats of Warangal urban environment during Feb-2012- Jan-2013 and Feb-2013-Jan-2014

Among these genera *Anopheles* percentage was high outdoor (60.80%, 52.79%) followed by *Culex* (60.75%, 57.22%) and *Aedes* (59.33%, 56.06%) and *Anopheles* (39.20%, 47.21%) followed by *Aedes* (40.67%, 43.94%) and *Culex* (39.25%, 42.78%) indoor during February 2012-January 2013 and February 2013-January

2014 respectively (Fig 1). No *Anopheles* and *Culex* mosquitoes were recorded in the habitats of tires, plastic containers, flower pots and mud pots. *Aedes* mosquitoes were not recorded in rice fields and construction pits during the study period. (Table 2)

Table 2: Mosquitoes collected from different outdoor habitats during the study period.

Habitats	<i>Anopheles</i> (%)		<i>Culex</i> (%)		<i>Aedes</i> (%)	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
Open type drainage	20.25	19.71	16.84	19.76	8.29	8.56
Sewage canal	22.31	25.73	20.62	23.71	9.27	9.23
Ditches	16.74	15.35	18.21	20.36	5.86	6.53
Cattle sheds	12.6	13.69	16.15	13.07	7.80	10.81
Rice fields	10.74	12.24	11.34	7.90	0.00	0.00
Construction pits	9.92	6.85	9.62	8.21	0.00	0.00
Cement tank	7.44	6.43	7.22	6.99	11.95	9.46
Tires	0.00	0.00	0.00	0.00	15.61	16.67
Plastic container	0.00	0.00	0.00	0.00	22.2	19.82
Flower pots	0.00	0.00	0.00	0.00	10.73	10.81
Mud pots	0.00	0.00	0.00	0.00	8.29	8.11

Anopheles species are the vectors of malaria [11]. These mosquitoes prefer to live in shady vegetation and cool water at outdoor habitat in urban ecosystems. Similar results have been reported by Nagpal and Dash *et al.* [9, 12]. *Aedes* species the vectors of chikungunya and dengue fever showed preference to live in plastic containers, cement tank, tires, and flower pots at outdoor. Similar observations have been recorded by Wangkoon *et al.*, [13]. *Culex* species are

vectors for filariasis and Japanese encephalitis and prefer to live-in sewage canals, ditches, cattle sheds, rice fields and open drainage system at outdoor habitats. This has been in accordance with the reports of Derraik and Slaney, Thongsripong *et al.*, [14, 15]. The mosquitoes at outdoor habitats, thus prefer to rest in drainage, sewage and shady vegetation and plastic containers etc.

Table 3: Diversity indices of mosquito species in Warangal urban environment during the study period (Feb-2012-Jan 2014)

Month	2012-13		2013-14	
	H	J	H	J
February	1.3672	0.9862	1.3145	0.9482
March	1.7750	0.9906	1.8179	1.0145
April	1.9148	0.9841	1.7908	0.9204
May	1.9346	0.9943	1.9399	0.9971
June	1.7813	0.9941	1.7885	0.9982
July	1.7760	0.9911	1.7868	0.9972
August	1.8887	0.9707	1.9134	0.9834
September	1.7790	0.9143	1.8960	0.7450
October	1.8997	0.9764	1.9108	0.9821
November	1.7860	0.9967	1.7747	0.9904
December	1.7408	0.9715	1.7755	0.9909
January	1.0796	0.9827	1.0749	0.9784

H=Shannon-Weiner diversity index, J=Evenness diversity index.

Species diversity was evaluated using Shannon-Wiener index (H) and Evenness index (J). The values of Shannon-Weiner index was founded in the range 1.7096 to 1.9346 and 1.0749 to 1.9399 during 2012-13 and 2013-14 respectively. The lowest value was recorded in January and the highest in May during both the years. The Shannon index showed high resemblance to each other during the study period for both the years. The values of Evenness index were between 0.9143-0.9943 and 0.745-1.0145 during 2012-13 and 2013-14 respectively. The lowest value was recorded in September and the highest in March during the study period. (Table 3)

4. Conclusion

The present investigation indicates that diversity indices and evenness were close and highly resemble to each other. The value under 1.0 (H) indicates the low quality of habitat that is supporting mosquito survival.

5. Acknowledgements

The authors are thankful to the Head, Department of Zoology, Kakatiya University for providing necessary facilities to carry out the present work in Environment Biology Lab.

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