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The Distribution of *Culex quinquefasciatus* Mosquito in Erode, Tamil Nadu, India

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Abstract

In the present study *Culex quinquefasciatus* mosquito vectors were recorded in the study area distributed throughout Perumpallam canal, Erode District. Mosquito larvae were collected duringthe study period Jan – Dec 2018 in ten locations utilizing long larval nets in different sites of breeding. Temperature, pH and salinity were also measured seasonally in these sites. The survey revealed that the most common vector was *Culex quinquefasciatus*. Mosquito in Erode are prevalent in four seasons, rarely encountered in summer, moderation during the winter and are found in maximum during the post monsoon period.

Keywords: *Culex quinquefasciatus*, Diversity, Mosquito Larvae, Seasonal Abundance, Vector-Borne Diseases

1. Introduction

The distribution of *Culex quinquefasciatus* mosquito species was most widespread in the Asian region causing serious health problems to human sand obstacles in socio economic improvement of developing countries. *Cx. quinquefasciatus* is the principal vector of *Bancroftian filariasis* and a potential vector of *Dirofilaria immitis*. Mosquitoes are responsible for the spread of malaria, yellow fever, dengue, filariasis, chikungunya transmitting disease to more than 700 million people annually. Worldwide, 76 countries are affected by lymphatic filariasis with about 32 million individuals being affected with chronic filariasis among one million are severely disabled. In India, seventeen states and six Union Territories were identified to be endemic among 553 million peoples, in which about 146 million live in urban and the remaining in rural areas were exposed to the risk of infection. About 31 million people are estimated to be the carriers of microfilaria with 23 million suffer from filarial disease manifestations[1]. In the absence of effective vaccine and drugs, prevention and control programs depends on the vector control.

The Diptera are among the most diverse insect orders, which estimates of described richness ranging from 1,20,000 to 1,50,000 specie[2–4]. Mosquitoes belonging to family culicidae are a large group of small insects present throughout the temperate and tropical regions and even beyond the Arctic circle of the world[5].

Targeting the larval stage control is crucial in eradicating mosquitoes, because of their inability to move from the habitats. Inspite of effective control by conventional synthetic insecticides, it causes health hazard to human and could lead to long-term residual effect to the environment as well as the development of resistance among the vectors stimulated a search for safer and effective alternative larvicidal formulation. The present study has undertaken the surveillance of Culex

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breeding habitats, assessment of the rain fall influencing larval population density in Erode, Tamil Nadu, India.

2. Materials and Methods

2.1 Study Area

In the present study, mosquito surveillance with special reference to *Culex quinquefasciatus* was accounted in Perumpallam canal, Erode District. It is situated between 10 36" and 11 58" North Latitude and between 76 49" and 77 58" East Longitude. For statistical purpose and the population richness, the study area Erode Perumpallam odai (EPO) was segregated into ten locations such as EPO-1 and EPO-10 (Figure 1).

2.2 Sample Collection

The water sample was collected from 10 different locations and particularly, mosquito highly breeding places for analysis. The samples were collected in plastic bottles/ containers and safely brought to the laboratory.

2.3 Survey of Mosquito Larval and Pupal Abundance

Larval and pupal collections were made from 10 different breeding places from the beginning of January to December 2018. The survey was conducted at every site and sampling was done two times per month, in two weeks time interval. Sample collection in the morning was from 7 to 9 am and that in the evening was from 4 to 5 pm. Every juvenile collection started on the 7th day (I Phase) and second larval collection (II phase) was on the 22nd day of every month. In total, 24 (12 x 2) juvenile collections per site were made in a year period and the adult emergence was recorded for sex ratio determination. Overall 72 larval-pupal samples were collected during the study period. Larvae and pupae were collected by means of handled larval nets, consisting of an iron ring (20 cm in diameter) to which a muslin sleeve (30 cm long) was attached. For the collection of mosquito larvae three methods, namely, dipping, netting and pipetting were commonly used.

Figure 1. Breeding habitats of mosquito in the study areas EPO-1 (A, B, C) and EPO-2 (D, E, F).

3. Result and Discussion

3.1 Selection of Study Area

The study area for mosquito surveillance was accounted in the waste water discharges of Perumpallam Odai, in Erode District, Tamil Nadu, India (Figure 1). It is situated at 10 36" and 11 58" North Latitude and between 76 49" and 77 58" East Longitude. The canal is about 20 kilometer, traverses from west to east across the city and flows into the Kaveri River. The study area has been segregated in to ten locations for statistical purpose as EPO-1, EPO-2, EPO-3, EPO-4, EPO-5, EPO-6, EPO-7, EPO-8, EPO-9 and EPO-10 (EPO-Erode Perumpallam Odai) (Table 1) and (Figure 2).

The survey was conducted in a filarial endemic place from January to December to know the rate of increase or decline in adult emergence. As per our statistical report it was clearly noticed that the mosquito population index had decreased in every summer and monsoon season. Around 33-66% of the population diminished due to the climatic factors, nutrient availability and reduced water level etc. in study area. More than 100 spots in EPO were noticed as severe zones of *Cx. quinquefasciatus* larval pupal abundance. Out of ten major zones EPO-1 to EPO-10, about 120 spots were identified as potential mosquito breeding sources in the study area. Among the 120 spots, 44 spots were identified as more prevalent mosquitoes breeding sites. EPO-4, EPO-5, EPO-6 and EPO-7 were found to be the highest mosquito breeding spots due to

Table 1. Profile of the mosquito breeding sites in the selected study area

Area of mosquito breeding sites(sq Km)	Mosquito abundance inbreeding site (No.)	Width of the sewage tunnel(Sq. Km)	Length of the Drainage (m)	Average pH of breeding site	Average Temperature of breeding site	Turbidity of the Drainage Water (N.T.U)
EPO-1	10	2	100	7.2-8.3	26-28	12
EPO-2	8	2.3	100	7.4-8.5	28-30	14
EPO-3	12	2	102	7.3-8.3	25-28	14
EPO-4	14	2	98	7.7-8.6	26-28	15
EPO-5	7	2.5	98	7.2-8.5	27-29	19
EPO-6	11	1.8	102	7.9-8.7	28-30	17
EPO-7	12	2.0	99	7.2-8.4	26-31	18
EPO-8	17	2.3	101	7.6-8.8	27-30	16
EPO-9	20	1.5	95	7.7-8.3	26-29	15
EPO-10	9	2.9	105	7.4-8.6	27-29	13

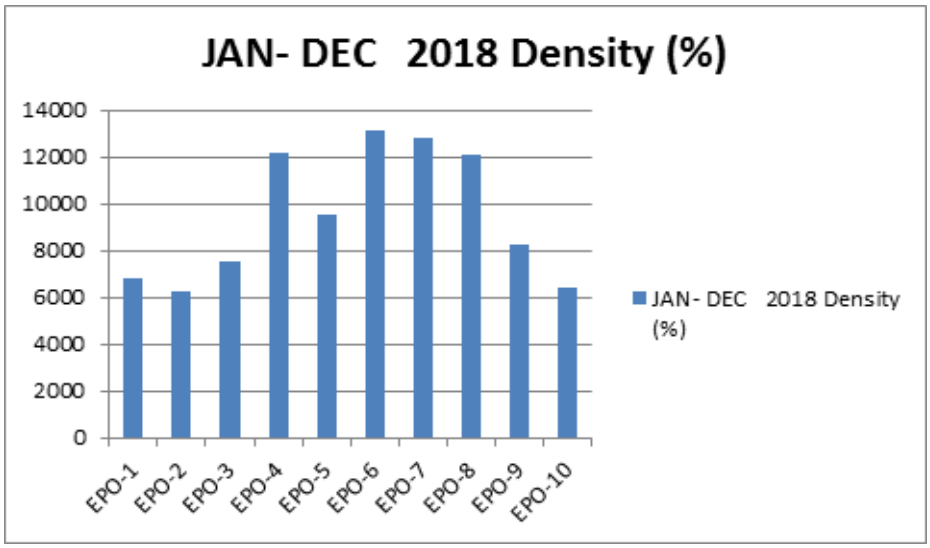

Figure 2. Monthly variation in the diversity of mosquito larvae in EPO-1 – EPO-10.

Table 2. Surveillance and collection of mosquito larva during the study period 2018

Study site	Breeding site (No.)	Total No. of larva detected during 2018												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
EPO-1	10	244	147	132	117	114	106	134	159	174	193	275	345	2140
EPO-2	8	167	134	126	119	116	98	127	135	139	147	179	192	1679
EPO-3	12	253	157	142	124	135	121	143	169	187	224	284	379	2318
EPO-4	14	494	187	179	152	163	137	167	177	284	367	558	667	3532
EPO-5	7	278	172	167	135	152	128	153	179	194	236	338	595	2727
EPO-6	11	583	292	186	147	172	129	189	293	364	489	677	723	4244
EPO-7	12	494	287	179	152	158	137	167	179	284	367	558	667	3629
EPO-8	17	359	254	186	174	137	158	175	196	267	384	542	653	3485
EPO-9	20	247	149	136	119	127	113	137	163	181	197	279	362	2210
EPO-10	9	173	137	123	118	115	121	135	149	153	166	186	197	1773
Total	120	3292	1916	1556	1357	1389	1248	1527	1799	2227	2770	3876	4780	**27737**

the plenty of garbage dumped into the waste water in these sites (Table 2).

3.2 Surveillance of *Cx. quinquefasciatus* Distribution in Waste Water Discharges

In this study the distribution of *Cx. quinquefasciatus* from EPO-1 to EPO-10 was measured. Larval and pupal collections were made from 10 different breeding places for the year 2018 from the beginning of January month to December. After that, a sub-set of water bodies were monitored periodically for every two weeks for vegetation cover, presence of fauna, turbidity, apparent pollution and exposure to sunlight based on visual observation. As per the observations there were slight variations in temperature, pH and electrical conductivity measurements in water sampling (Table 1). The coordinates of potential vector breeding sites were recorded with the help of hand held dipper. The suitable mosquito surveillance was determined at the study site and sampled two times per month, with two weeks interval between each sampling. The samples were collected during morning time 7 to 9 am and evening time 4 to 5 pm.

3.3 Seasonal Variation and the Effect of Environmental Factors on Mosquito Productivity

Averages of 31,689 mosquitoes belonging to various species were collected from the ten localities over a one year sampling period from 2018. A percentage of 95.3%

Table 4. Seasonal surveillance of various stages of *Cx. quinquefasciatus* abundancy in various breeding site (EPO)

Seasons	**Months**	**Abundance of the various stage of *Cx. quinquefasciatus* during 2018**		
		Abundance of Larva and pupa population	**Abundance of Pupa and adult population**	**Abundance of Adult population in adjacent areas**
Winter		2016	2016	2016
	Jan	++	++	++
	Feb	+	+	+
Summer	Mar	+	+	+
	April	+	+	+
	May	+	+	+
Monsoon	June	+	+	+
	July	+	+	+
	August	+	+	+
	September	+	+	+
Post-monsoon	October	+++	+++	+++
	November	+++	+++	+++
	December	++	++	++

+ indicates that <200 larvae found.
++ indicates that <500 larvae found.
+++ indicates that <1000 larvae found.

of species were found to be *Cx. quinquefasciatus* in the selected site. The densities of *Cx. quinquefasciatus* were maximum during the post monsoon period (October-January). Mosquito productivity was abundant in the study sites EPO-4 to EPO-7 where the water was found to be stagnant (Table 4).

"*Cx. quinquefasciatus*, a major threat vector for filariasis, is one of the diverse mosquitoes which arises in human occupancies in the tropics and subtropics of the ecosphere". There has been a huge upsurge in the insecticide resistance of this vector and it has turn in to a universal difficult[6]. Moreover, juvenile breeding source such as sewage water and stagnant water, also adult source animals and drunken human are equally important for prevalence of mosquitoes and also vector born diseases. Hence, the present study has been initiated to monitor the juvenile breeding source in and round Erode district, particularly sewage water system for *Cx. quinquefaciatus* from egg to adult. Since, limited studies have been carried out to address the issue of *Cx. quinquefasciatus* in domestic sewage in various localities of Erode districts.

Mosquitoes (Diptera: Culicidae) symbolize a key danger for the global population since they act as vectors for dreadful disease causing pathogens which include dengue filariasis and malari[7–9]. Therefore, surveillance, of *Cx. quinquefasciatus* juvenile breeding habitats and their population density was measured at different localities within twenty kilometres in the surroundings of Erode district. As a result *Cx. quinquefasciatusis* the most predominant mosquito (29 to 32%) that was observed during the course of study from January to December 2018.

Cx. quinquefasciatus was widely distributed and oviposited in the sewage water thought the study area such as EPO-1 and EPO-10 and also the impact of weather conditions on *Culex* population and distribution was calculated. "A wide type of sites, principally characterized by colored, foul water with high nutrient values and low dissolved zero content, like pumping and irrigation wells, canals, waste product treatment ponds, waste material overflows, rain pools, fields, fish ponds, septic tanks, drains, cesspools, agricultural trenches, vegetable farms etc. Generally are preferred as the breeding sites by this mosquito"[10,11].

3.4 Surveillance of *Cx. quinquefasciatus* Distribution in Waste Water Discharges

A survey of *Cx. quinquefasciatus* was made between January to December 2018. Mosquitoes were collected from ten sites in the selected sites, using carbon dioxide-baited traps, human landing and larval collections. Specimens were identified morphologically and polymerase chain reaction assays were subsequently done. The relative frequency of *Culex* species was calculated against the total catch during the sampling period. Relative abundance of members of the selected species was determined for each collection site. Seasonal variations in mosquito abundance were assessed by correlating with different seasons. During each collection period, environmental variables (temperature, rainfall, humidity and wind speed) were recorded. The increase in mosquito abundance co-related with increase in humidity and temperature of the recorded climate data of the study area. Studies indicated that the home ground quality within which mosquitoes oviposited was the main issue behind increased offspring survival and growth. Thus, once the potential habitats dissent in their suitableness for juveniles, females used to the habitats which might maximize the fitness of the juveniles.

In the present study, surveillance of *Cx. quinquefasciatus* population dynamics i.e., population emergence ratio and sex ratio, particularly in the developmental stages of larvae and pupae were undertaken to monitor their adult prevalence and distribution in the study area. Very limited studies have been carried out to address the issue of *Cx. quinquefasciatus* in domestic sewage in various localities. The present study is about the surveillance of *Cx. quinquefasciatus* breeding habitats and their population density within 20 kilometers radius of Erode. *Cx. quinquefasciatus* is the most predominant mosquito species in Erode, particularly in stagnant water bodies. The *Cx. quinquefasciatus* mosquito were (29 to 32%) was observed during 2018. *Cx. quinquefasciatus* was widely distributed in Erode Perumpallamodai (EPO) the study area EPO-1 to EPO-10.

Abudullah and Merdan, (1995)[12] found that abundance of *Cx. pipiens* was comparatively high throughout the months of March–November and Al–Khreji, (2005)[13]

rumoured that dipterous insect abundance reduced throughout the winter season in national capital district.

4. Conclusion

During 2018, the overall mosquito population density was higher in stagnant water than in the domestic Sewage 37.5%. In the present study the mosquito larvae in waste water remained stable in distribution. It is also possible that the emerged adult mosquitoes might have migrated to nearby area which would have been rich source of nutrients. The other possibility is that *Culex* would have been the most common species in the study area, varying in richness in summer and spring seasons.

5. References

1. WHO Guidelines for Laboratory and Field Testing of Mosquito Larvicides. World Halth Organization document WHO. 2005.
2. Colles DH, McAlpine DK. Diptera (files) In Commonwealth Scientific and Industrial Research Organisation (Division of Entomology). The Insects of Australia. Second Edition. Vol. 2. Ithaca: Cornell University Press; 1991. p. 717–86.
3. Brown BV. Flies, gnats and mosquitoes. S. A. Levin (ed). Encyclopedia of Biodiversity. London: Academic Press; 2001. p. 815–26. https://doi.org/10.1016/B0-12-226865-2/00123-1
4. Merritt RW, Courtney GW, Keiper JB. Diptera in V. H. Resh and R. T. Cardeeds. Encyclopedia of Insects. London: Academic Press; 2003. p. 324–40.
5. Harbach RE. The Culicidae Diptera: A review of taxonomy, classification and phylogeny. Zootaxa. 2007; 1668:591–638. https://doi.org/10.11646/zootaxa.1668.1.28
6. Kovendan K, Murugan K, Vincent S, Kamalakannan S. Larvicidal efficacy of Jatrophacurcas and bacterial insecticide, Bacillus thuringiensis, against lymphatic filarial vector, Culex quinquefasciatus say (Diptera:Culicidae). Parasitology Research, 2011; 109(5):1251–7. PMid: 21537989. https://doi.org/10.1007/s00436-011-2368-6
7. Mehlhorn K. Data structures and algorithms 2: Graph algorithms and NP-completeness (Vol. 2). Springer Science and Business Media. 2012.
8. Roni M, Murugan K, Panneerselvam C, Subramaniam J, Nicoletti M, Madhiyazhagan P, Canale A. Characterization and biotoxicity of Hypnea musciformis-synthesized silver nanoparticles as potential eco-friendly control tool against Aedes aegypti and Plutella xylostella. Ecotoxicology and Environmental Safety. 2015; 121:31–8. PMid: 26184431. https://doi.org/10.1016/j.ecoenv.2015.07.005
9. Benelli G. Research in mosquito control: Current challenges for a brighter future. Parasitology Research. 2015; 114(8):2801–5.
10. Matthys B, N'Goran EK, Kone M, Koudou BG, Vounatsou P, Cisse G, Utzinger J. Urban agricultural land use and characterization of mosquito larval habitats in a medium-sized town of Cote d'Ivoire. Journal of Vector Ecology. 2006; 31(2):319–33. https://doi.org/10.3376/1081-1710(2006)31[319:UALUAC]2.0.CO;2
11. Opoku-Duah S. Remote sensing of energy and water fluxes over Volta Savannah catchments in West Africa (Doctoral dissertation, Durham University). 2007.
12. Al-Khreji MA. Survey and distribution of mosquito species (Diptera:Culicidae) and description of its hábitat in Riyadh district, Kingdom of Saudi Arabia. A Thesis of Master Sciences/Entomology, King Saud University. Riyad-Saudi Arabia. 2005.
13. Abdullah MA, Merdan AI. Distribution and ecology of the mosquito fauna in the south western Saudi Arabia. Journal of the Egyptian Society of Parasitology. 1995; 25(3):815–37.