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**Research Article**

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# Influence of some environmental factors on the abundance of adult mosquito species in a salt pan area near Ennore creek, Chennai.

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## Abstract

Diversity and abundance of mosquitoes in a salt pan area with reference to some important environmental factors in a salt pan area near Ennore Creek, Chennai was studied. The study revealed the presence of three species of mosquito belonging to two genera namely *Culex (Culex)sitiens*, *Culex (Culex)tritaeniorhynchus* and *Anopheles(Cellia)subpictus* during the period of study that is from September 2004 to March 2006 and the density of the adult mosquito species fluctuated with environmental factors.

**Keywords:** Mosquito, *Culex (Culex)sitiens*, *Culex (Culex)tritaeniorhynchus*, *Anopheles(Cellia)subpictus*, salt pan area

## Introduction

The life of mosquito is influenced by environmental factors. The importance of climate and weather is obvious since mosquitoes are cold blooded living organisms. The species richness of mosquitoes in a given area is modulated by the biotic and abiotic factors prevailing in that area. In depth knowledge on the factors that govern vector mosquito density is indispensable for vector and disease control. Mosquitoes can have both positive and negative influences in the ecosystem. As part of their role, the larvae of mosquitoes live in water and provide food for fish and other wildlife usefully, including dragonfly larvae. The mosquito larvae are very much useful to recycle the matter in aquatic ecosystem since the ear microscopic matters. Adult mosquitoes make up part of the diet of some insect-eating animals, such as birds, bats, adult dragonflies and spiders. They can also act as pollinator of few flowers, when they consume nectar of such flowers. Mosquitoes also can have a damaging role, harming other animals by being a vector for spreading diseases, such as malaria, yellow fever, encephalitis and dengue. The alone never cause any disease and only they can act as carriers of disease causing pathogens (vectors). In places where a particular disease is not prevalence, there's no risk of catching them, but ecologists worry, because if infected humans or animals do come into the area, the mosquitoes that already live there will spread the disease among the rest of the healthy population.

## Materials and Methods

Species diversity of adult mosquitoes inhabiting salt pan area near Ennore creek (longitude 80° 15'E; latitude 130° 05'N) reveals three species and two genera namely *Culex (Culex)sitiens*, *Culex*

*(Culex) tritaeniorhynchus* and *Anopheles (Cellia) subpictus*. 1092 Adult mosquitoes were collected throughout the study period for one hour every two weeks during dawn and dusk from human dwellings and outdoor shrubs (including mangrove vegetarian) using Aspirators (M.W. Service, 1976) in the salt pan area. *Culex (Culex) sitiens* comprise 42.5% (464 numbers) *Anopheles (Cellia) subpictus* consist of 41.2% (450 numbers) and the remaining 16.3% (178 numbers) represented by *Culex (Culex) tritaeniorhynchus* vector mosquitoes. The adult mosquito density is expressed in per man hour (MHD) for each month about 228 man hours were spent for collection of mosquitoes during the study period. Data on weather was also collected during the entire study period.

## Results and Discussion

Monthly Adult mosquito densities of various species of mosquitoes collected during dawn and dusk from salt pan area during the study period (Sept. 2004 to March 2006) are tabulated (Tables 1&2). Similarly the meteorological data during the study period Sept. 2004 to March 2006 in the Salt pan area are tabulated (Tables 3 &4; Figures 1-4).

**Table –1: Month wise densities of various adult mosquito species per man hour (MHD) collected during dawn and dusk from salt pan area during study period (September 2004 – June 2005)**

| Mosquito Species | Month and year of the study period | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sept. 2004 | Oct. 2004 | Nov. 2004 | Dee. 2004 | Jan. 2005 | Feb. 2005 | Mar. 2005 | Apr. 2005 | May. 2005 | Jun 2005 |
| *Culex (Culex)sitiens* | 2.49 | 3.41 | 3.16 | 4.24 | 2.66 | 2.83 | 0.41 | 0.41 | 0.16 | 0.41 |
| *Culex (Culex)tritaeniorhynchus* | 0.99 | 1.41 | 1.74 | 1.08 | 0.58 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 |
| *Anopheles(Cellia)subpicus* | 2.58 | 3.49 | 2.74 | 3.24 | 2.41 | 1.83 | 1.83 | 0.49 | 0.16 | 0.41 |

**Table –2: Month wise densities of various adult mosquito species per man hour (MHD) collected during dawn and dusk from salt pan area during study period (July2005– March 2006)**

| Mosquito Species | Month and year of the study period | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jul. 2005 | Aug. 2005 | Sep. 2005 | Oct. 2005 | Nov. 2005 | Dec. 2005 | Jan. 2006 | Feb. 2006 | Mar. 2006 |
| *Culex (Culex)sitiens* | 0.41 | 0.49 | 2.74 | 2.58 | 3.75 | 3.08 | 3 | 2.08 | 0.24 |
| *Culex (Culex)tritaeniorhynchus* | 0.24 | 0.16 | 1.24 | 1.83 | 1.99 | 1.58 | 0.83 | 0.41 | 0.24 |
| *Anopheles(Cellia)subpicus* | 0.41 | 0.49 | 2.91 | 3.3 | 3.08 | 3 | 3.41 | 3.08 | 0.16 |

The per man hour density (MHD) of adult *Culex (Culex)tritaeniorhynchus* mosquitoes in salt pan area during each month of the study period varied between 0.16 MHD and 1.99 MHD with 2 maximum peak MHD one in Nov. 2004 (1.74 MHD) and another in Nov. 2005 (1.99 MHD). The per man hour density (MHD) of adult *Anopheles(Cellia)subpictus* mosquitoes in the study area during the study period varied between 0.16 MHD and 3.49 MHD with 2 maximum peak MHD one in Oct. 2004 (3.49 MHD) and another in Jan.2006 (3.41 MHD). The per man hour density of *Culex (Culex)sitiens* mosquito inhabiting salt pan area during the study period varied between 0.16 MHD and 4.24 MHD with 2 maximum peak MHD one in Dec. 2004 (4.24 MHD and another in Nov. 2005 (3.75 MHD)

**Table 3.Selected environmental factors in the seasonal abundance of different mosquitoes in the study area during the study period (from September 2004 to June 2005)**

| Sl. No. | Environmental Factor | Sept. 2004 | Oct. 2004 | Nov. 2004 | Dec. 2004 | Jan. 2005 | Feb. 2005 | Mar. 2005 | Apr. 2005 | May. 2005 | Jun. 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Number of Rainy Days | 10 | 14 | 7 | 1 | 0 | 1 | 0 | 2 | 1 | 3 |
| 2. | RH (%) | 76.5 | 80 | 79 | 71 | 72 | 70 | 71.5 | 75 | 69.5 | 56 |

**Table 4.Selected environmental factors in the seasonal abundance of different mosquitoes in the study area during the study period (from July 2005 to March 2006)**

| Environmental Factor | Month and year of the study period | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jul. 2005 | Aug. 2005 | Sep. 2005 | Oct. 2005 | Nov. 2005 | Dec. 2005 | Jan. 2006 | Feb. 2006 | Mar. 2006 |
| Number of Rainy Days | 6 | 4 | 7 | 16 | 16 | 10 | 1 | 0 | 1 |
| RH (%) | 67.5 | 68.5 | 70 | 81.5 | 80.5 | 84 | 73 | 69 | 71.5 |

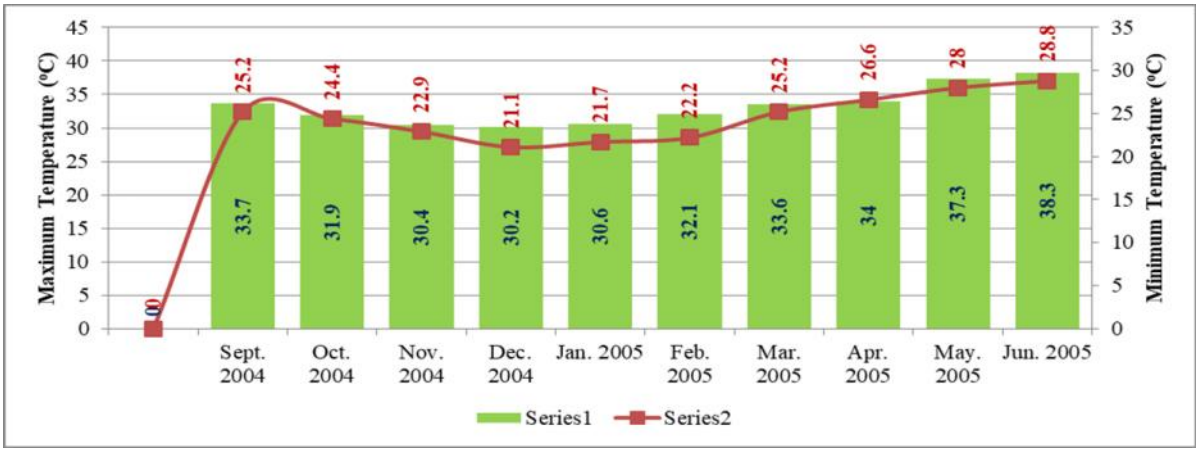


**Figure 1. Variations in the temperature observed from the study area during the study period (from September 2004 to June 2005)**

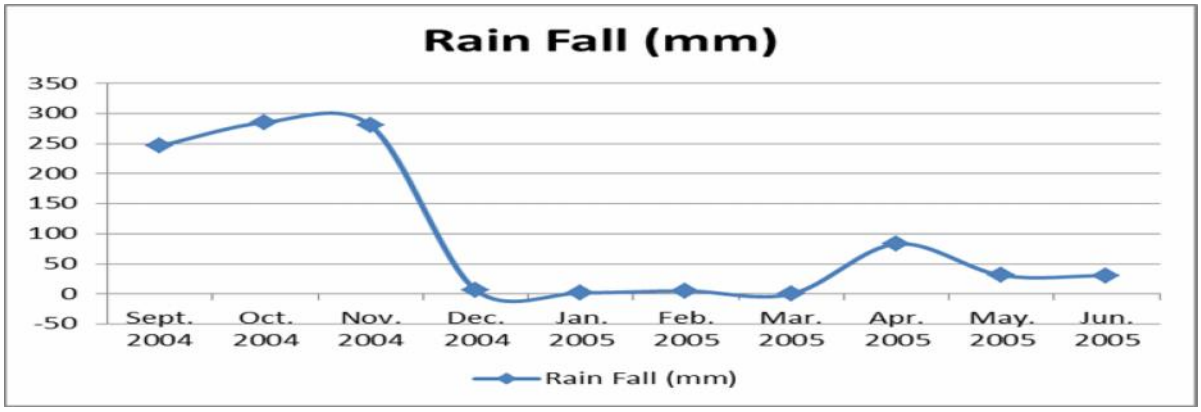


**Figure 2.Total rainfall observed from the study area during the study period (from September 2004 to June 2005)**

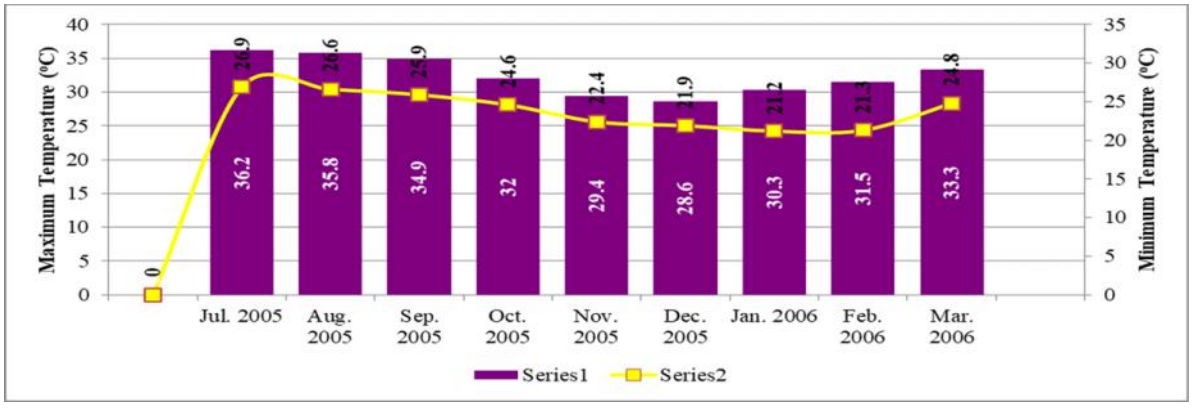


**Figure 3. Variations in the temperature observed from the study area during the study period (from July 2005 to March 2006)**

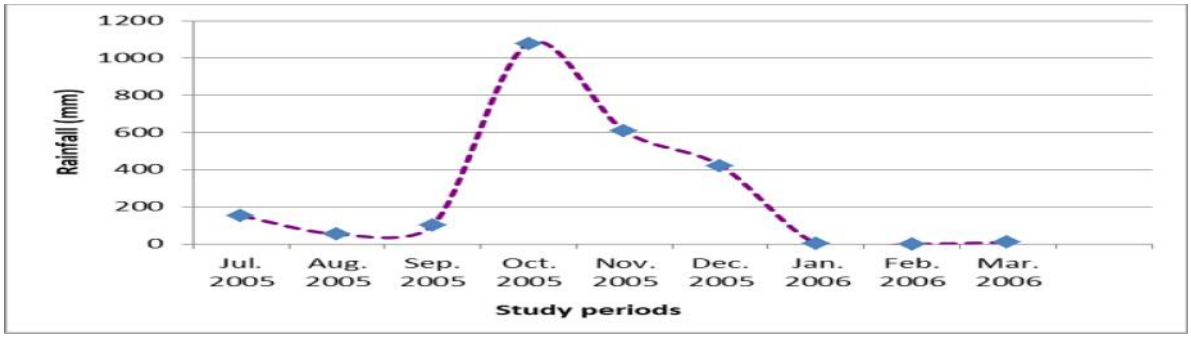


**Figure 4.Total rainfall observed from the study area during the study period (from July 2005 to March 2006)**

To examine the interrelationship between entomological and meteorological variable Pearson's correlation was used. Pearsons correlation coefficients were calculated between environmental variable namely minimum temperature, maximum temperature, rainfall, rainy days, relative humidity and abundance of different species of adult mosquitoes (MHD). Examination of patterns of correlation (TABLE5) revealed that *Culex (Culex)sitiens* MHD (abundance) had a highly significant correlation with minimum temperature (r=-0.818; p<0.01) *i.e.*, when minimum temperature decreases, the *Culex (Culex)sitiens* MHD (abundance) increases. Similarly *Culex (Culex) sitiens* MHD was negatively correlated with maximum temperature (r=-0.7833; p<0.01). *Culex (Culex)sitiens* MHD was positively correlated with relative humidity (r=0.5433; p<0.05). Similarly *Culex (Culex)sitiens* MHD was positively correlated with rainfall (r=0.3499; p>0.05) and rainy days (r=0.4170; p>0.05).

**Table 5: Correlation coefficients values showing relationships between abundance of each mosquito species and environmental factors**

| Mosquito Species | Minimum Temperature | Maximum Temperature | Rainfall | Rainy Day | Relative Humidity |
|---|---|---|---|---|---|
| *Culex (Culex)sitiens* (MHD) | -0.8018** | -0.7833** | 0.3499 | 0.4170 | 0.5443* |
| *Culex (Culex)tritaeniorhynchus* (MHD) | -0.6343** | -0.4200 | 0.7606** | 0.8070** | 0.7570** |
| *Anopheles(Cellia)subpictus* (MHD) | -0.7150** | -0.7438** | 0.0269 | 0.2381 | 0.4100 |

The correlations value between *Culex (Culex) tritaeniorhynchus* MHD (abundance) and environmental factors reveal that there is significant negative correlation between minimum temperature and (abundance) MHD (r = -0.6343; p < 0.01). *Culex (Culex) tritaleniorhynchus* MHD (abundance) is significantly positively correlated with rainfall (r = 0.7606; p < 0.01) and *Culex (Culex) tritaeniorhynchus* MHD is positively correlated significantly with rainy days (r = 0.8070; p < 0.01). Similarly *Culex (Culex) tritaeniorhynchus* MHD is positively correlated with relative humidity (r = 0.7570; p<0.01). *Culex (Culex) ttitaeniorhynchus* MHD negatively correlated with maximum temperature (r = -0.4200; p > 0.5).

The correlation coefficient values between *Anopheles (Cellia) subpictus* MHD (abundance) and environmental factors revealed that *Anopheles(Cellia)subpictus* MHD (abundance) is negatively correlated significantly with minimum temperature (r = -0.7150; p < 0.1) and similarly *Anopheles (Cellia) subpictus* is negatively correlated with maximum temperature (r=-0.7438; p<0.01) whereas *Anopheles (Cellia) subpictus* MHD is positively correlated with rainfall (r = 0.0269; p > 0.05); with rainy days (0.2384; p > 0.05) and with relative humidity (r = 0.4100; p>0.05) respectively. The study reveals that the density of all the three mosquito species inhabiting salt pan area are influenced by environmental factors, namely minimum temperature, maximum temperature, rainfall, number of rainy days and relative humidity. *Culex (Culex) sitiens* and *Culex (Culex) tritaeniorhynchus* were found to rest on mangrove plants which is in accordance with findings of Rajavel *et. al* (2001).

Vinod and Bansal (1991) observed that *Culex (Culex) tritaeniorhynchus* was found to rest outdoor around saline water collection which is in accordance with our findings. Ilango (2005) reported that *Culex sitiens* is a common species on sea coasts and breeds in brackish water pools and *Culex tritaeniorhynchus* in salt marshes. The present findings revealed that species diversity is exhibited by mosquitoes inhabiting salt pan area where brackish water breeder *Culex sitiens* and fresh water breeder. *Culex (Culex) tritaeniorhynchus* and *Anopheles(Cellia)subpictus* found to breed both in fresh water and brackish water and were found to co-exist in this adverse saline habitat. Suryanarayana Murthy *et.al* (2002) observed that population densities of members of *Culex vishnui* subgroup of mosquitoes followed rainfall pattern which is in accordance to our findings ie., the abundance of *Culex tritaeniohynchus* a member of *Culex vishnui* subgroup of mosquitoes followed the rainfall.

It was found that the MHD (abundance) of all the three mosquito species inhabiting the salt pan area increased with increase in rainfall pattern, number of rainy days and relative humidity, whereas an increase in minimum temperature during summer and non-monsoon season resulted in decrease in MHD (abundance) of all the three mosquito species, inhabiting salt pan area. It was also found that when maximum temperature decreased, adult mosquito density of all three mosquito species namely *Culex sitiens*, *Culex tritaeniorhynchus* and *Anophelessubpictus* increased.

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