The Journal of Zoology Studies
We Don't Love Animals, We Live For Them
www.journalofzoology.com

ISSN 2348-5914
JOZS 2015; 2(1): 01-08
JOZS © 2015
Received: 04-12-2014
Accepted: 27-01-2015

Altitudinal variation in density of mosquito in Thiruvannamalai Temple, a hilly area, Srivilliputtur Taluk, Virudhunagar district, Tamilnadu, India

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Abstract

The prominent of them are the increase in human population, irrigation of crops, flooded rice fields, unplanned sanitation, urban development, the migration of bird, rainfall, temperature, humidity and dry arid condition and the changing life style of the population in cities, urban, sub-urban and rural areas of our nation. Altitudinal variation of mosquitoes was studied by collecting the mosquitoes using human bait sampling method during September 2009 to February 2010 from four habitats such as residential area, low altitude (78ft), transition altitude (156ft) and high altitude (234ft) of a rural ecosystem at Venkateshwarapuram village near Srivilliputtur. The density of mosquitoes was more in moderate rainy season than the acute rainy and winter seasons. Among the eight species recorded in the study area, *Culex quinquefasciatus* exhibited highest density and followed by *Culex pseudovishnui* and *Anopheles subpictus*. The other species showed moderate or less density. Variation in the density of mosquitoes was also observed. The density of mosquitoes was higher during moderate rainy season and winter season followed by acute rainy season.

Keywords: Density of mosquitoes, Altitudinal variation, Pattern of occurrence, Rainy season

1. Introduction

Mosquitoes are medically important group of insects both in number of health problems and the diseases caused (Merrit *et al.* [1]) Mosquitoes are considered as serious nuisance pest and vectors of many dreadful disease both in the urban and rural area (Pandian *et al.* [2]) Mosquitoes are considered as the most potential vectors due to infection of very painful bites (Srivastava, [3]) of all the vectorial species, mosquito is of immense importance as it challenges and threats to human by its dreadful transmission of viral disease that ranges from malaria to chikungunya, Japanese encephalitis, dengue and filariasis. The dreadful mosquito species of these diseases are *Aedes, Anopheles, Armigeres, Culex* and *Monsonia* (Mukunda, [4]). Seasonality and circardian rhythm of mosquito population as well as other ecological and behavioural features are strongly influenced by climatic factors such as temperature, rainfall humidity, wind and duration of day light.

Both seasonal and daily activity patterns of mosquito vectors are required as baseline knowledge to understand the dynamics of vector-borne pathogens and have been widely studied for many mosquito species throughout the world. (Loetti *et al*. [5]). For nearly three decades countries on the earth have been in a warming phase. The potential impact of global warming on human health is subjected to debate. Keeping this in view the climatic factors such as temperature and rainfall may alter the distribution of the vector population to increase or decrease and in turn the intensity of disease transmission which depends on the weather of the locality i.e., favourable or unfavourable for mosquito breeding condition (Devi and Jauhari, [6]). The diversity of mosquitoes shows geographical variation. Hence the present study "Altitudinal variation in density of mosquitoes of Thiruvannamalai Temple, Srivilliputtur taluk" was undertaken with reference to seasonality and abiotic factors (Rainfall).

2. Materials and Methods

2.1 Study Site

The study was conducted in Thiruvannamalai(Hill) Temple and nearby residential area. It is encircled by agriculture fields and other kinds of mosquitogenic places and the height of the hill is approximately 234^{ft} from the ground level. This temple is also called as "Then Thiruppathi" .The number of visiting devotees from other districts of Tamilnadu increased for many folds during the month of September. The study area also comprised of various types of human settlement and varying number of cattles and other animals that favour the mosquito population. Four sites have been selected on the basis of the location of breeding habitats and the availability of vertebrate hosts for the mosquitoes (Figure.1)

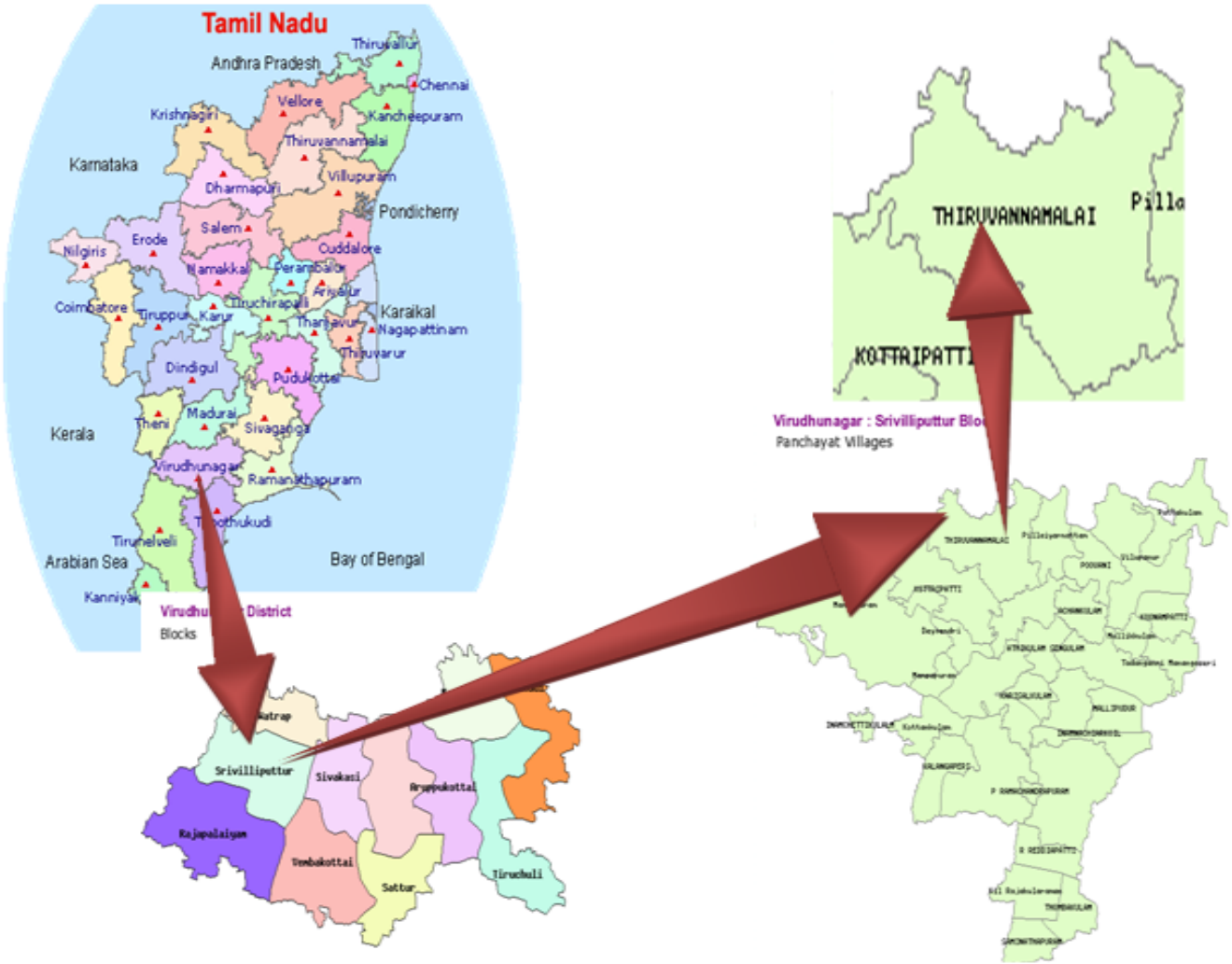


Fig 1: Geographical location of study area.

The biting mosquitoes were collected for a period of 12 hours continuously. Human-bait sampling method was used to study the diversity of mosquitoes. All the preserved wild–caught mosquitoes were identified upto species level by the Entomologists, Centre for Research in Medical Entomology (ICMR), Madurai. Mosquito diversity was evaluated using species richness index or alpha diversity to assess the degree of biodiversity. Knowledge on the pattern of occurrence of mosquitoes reveals the dimension of pattern of occurrence and the rate of existence in the selective study sites. Types of species were identified based on the relative density. The density was usually provided as the mean number of individuals. The density pattern was analyzed using the method of Rydzanicz and Lonc [7].

3. Results and Discussion

3.1 Altitudinal Variation

Among the four sites of the study area, there was no marked difference in the density of mosquitoes except in high altitude region (234ft). From the site-wise collection of mosquitoes recorded in the study area, minor variation was noticed in the density of mosquitoes. Anyhow, the recorded density of maximum in the residential site followed by low altitude, transition (altitude) area and high altitude as shown in the Figure 2. During the period of study the density of mosquito species differ from different altitudes. The high altitude region (234ft) shows high species richness which includes 6 species namely *Aedes aegypti, Aedes vittatus, Anopheles stephensi, Culex pseudovishnui, Culex quinquefasciatus* and *Monsonia uniformis* were found. Because the high altitude site has varieties of breeding grounds which were not reached by human. That may be the reason for higher density pattern of mosquitoes. Elevation greatly influenced mosquito densities due to its modifying effect on temperature and humidity. Mosquitoes were present at altitudes greater than 1200 meter, indicating that such areas would not remain free of hosts in the light of the modifying effects to the ecosystem associated with human influences on both local and global scale (Josephat *et al.* [8]). Devi and Jauhari [9] also reported that cultivation pattern, existance of irrigation channals and low humidity were the main parameters in maintaing density of mosquitoes of Garhwval region, Uttrahand state, India. Hence the density of mosquitoes was found to be higher in residential sites and moderate both in transition (altitude) area (156ft) and low altitude (78ft) regions. Similar results were observed by Tubaki *et. al.* [10] in the Southern region of Brazil.

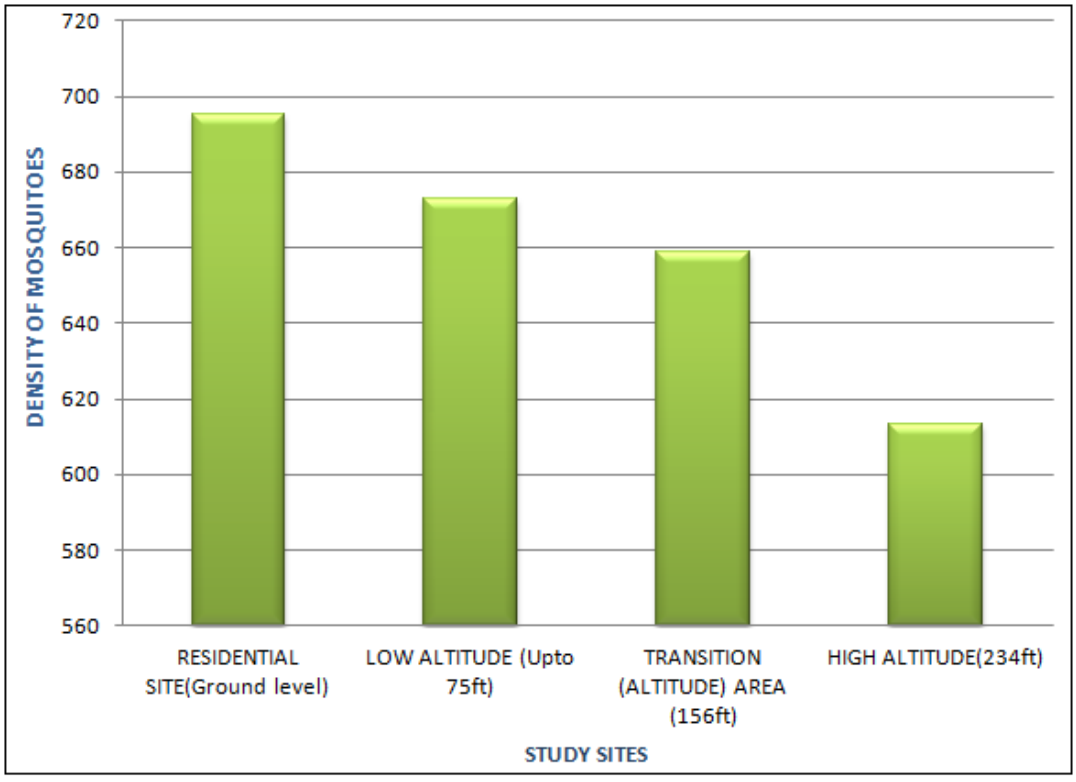
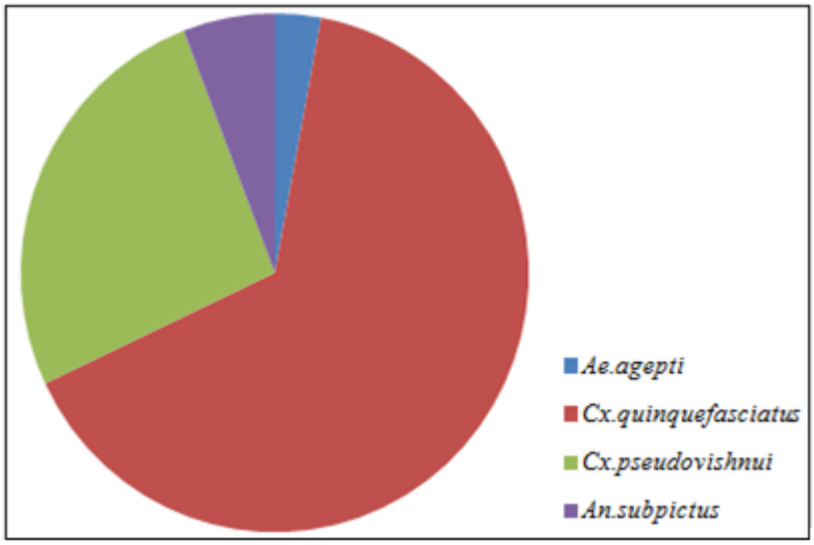


Fig 2: Altitudinal variation in density of mosquitoes recorded in the study area during the study period (Sep 2009-Feb 2010).

3.2. Density

The density of man biting mosquitoes collected during the study period was shown in the Table 1. A total of 2640 individuals of mosquitoes of five genera were collected and recorded. The density of mosquitoes was more in moderate rainy season than the acute rainy and winter seasons. Among the eight species recorded in the study area, *Culex quinquefasciatus* exhibited highest density and followed by *Culex pseudovishnui* and *Anopheles subpictus*. The other species showed moderate or less density. Variation in the density of mosquitoes was also observed. The density of mosquitoes was higher during November 2009 to December 2009 (Moderate rainy season) and January 2010 to February 2010 (winter season) followed by September 2009 to October 2009 (Acute rainy season) which is shown in the Figure. 3, 4 and 5.Variation in density of mosquitoes during each month of study period were calculated.



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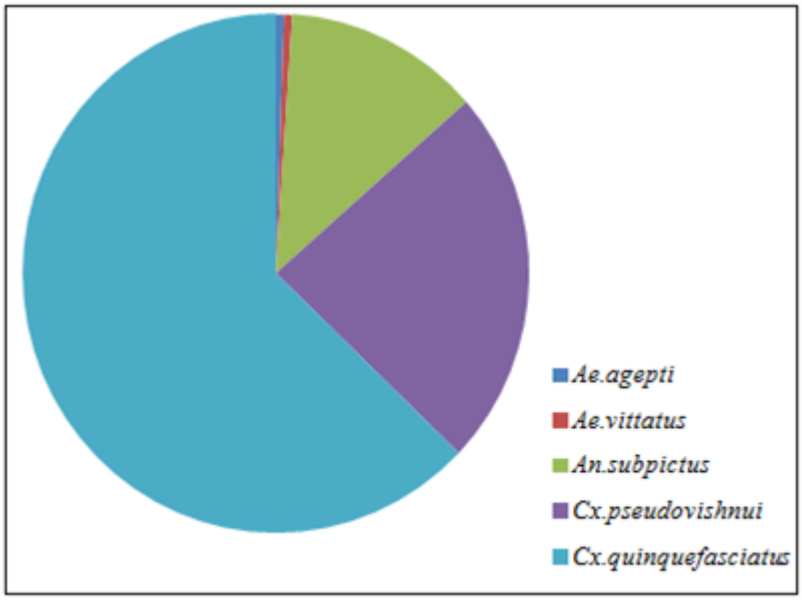

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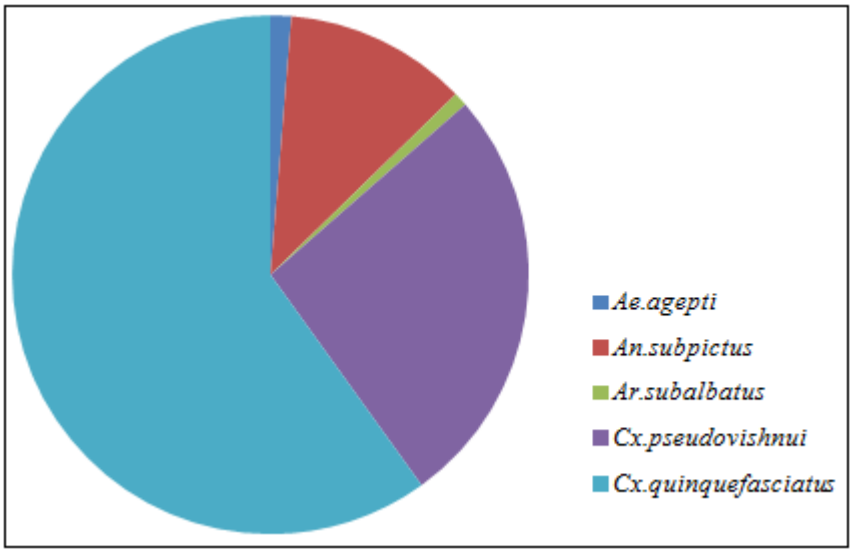
Fig 3: Density of mosquitoes collected in the study area during acute rainy season (Sep 2009– Oct 2009)



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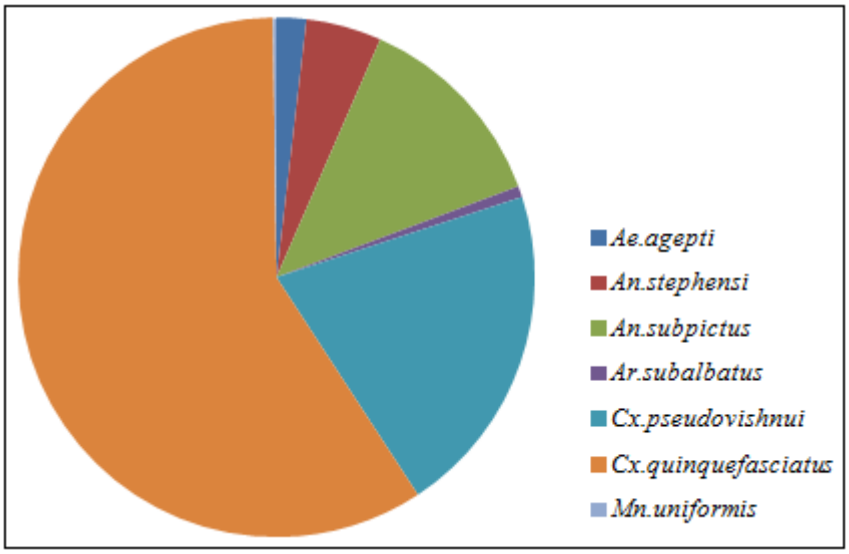

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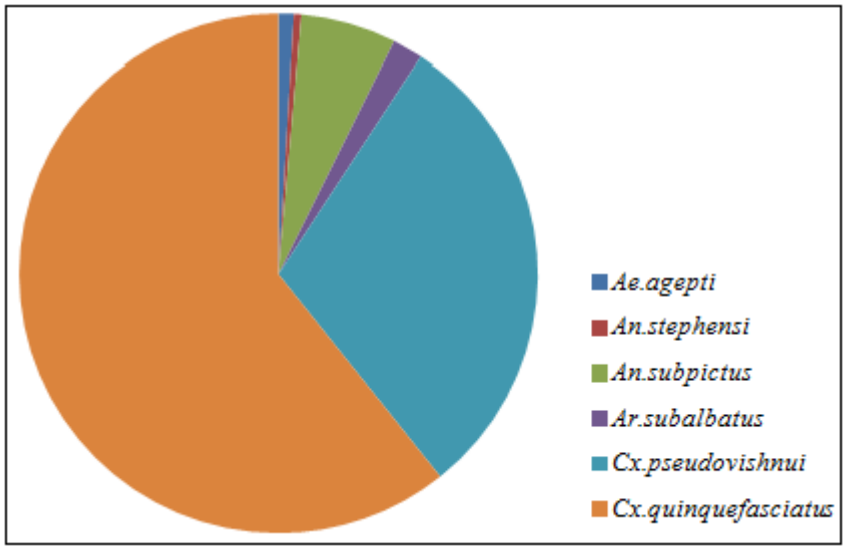
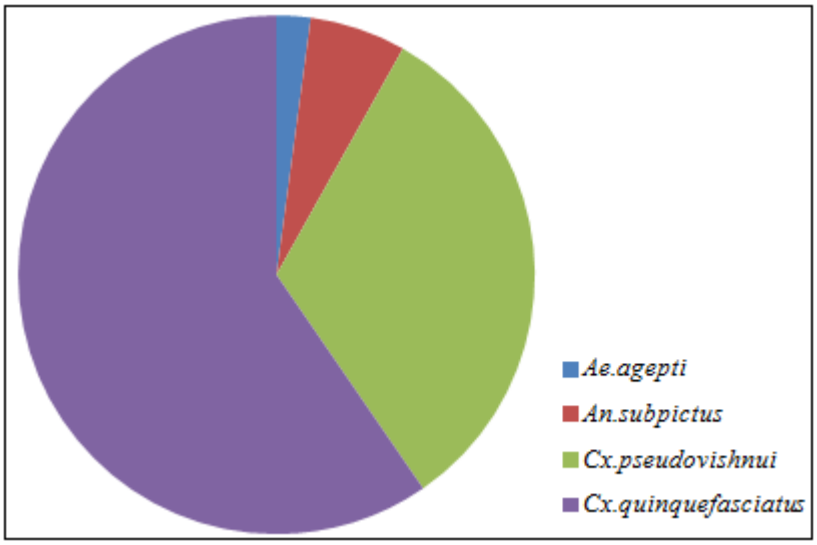
Fig 4: Density of mosquitoes collected in the study area during Moderate rainy season (Nov 2009- Dec 2009)



JANUARY'10



FEBRUARY'10

Fig 5: Density pattern of mosquitoes recorded in the study area during the study period (Jan 2010 - Feb 2010)

The density of *Culex quinquefasciatus* was higher than the other species in all the months; the density of *Culex pseudovishnui* was more or less similar throughout the study period. *Anopheles subpictus* exhibited reasonable density during the study period and the density was more in moderate rainy season than other seasons. *Aedes aegypti* was found moderate in number in all the months. *Aedes vittatus, Anopheles stephensi* and *Armigeres subalbatus* occurred in less density. Variation in the status of mosquitoes which was based on the density has been shown in the Figure 6. Out of the eight mosquitoes recorded, *Culex quinquefasciatus, Culex pseudovishnui* and *Anopheles subpictus* exhibited dominant status. *Aedes aegypti* exhibited sub-dominant status and the remaining four species were considered as satellite species because of low density. Mosquitoes serve as intermediate host in the transmission of various diseases in recent years. The density of mosquitoes and occurrence of mosquito borne diseases have been changing continuously for reasons such as increasing rates of environmental corruption, climatic changes urbanization and the increasing human population (Simsek, [11]).

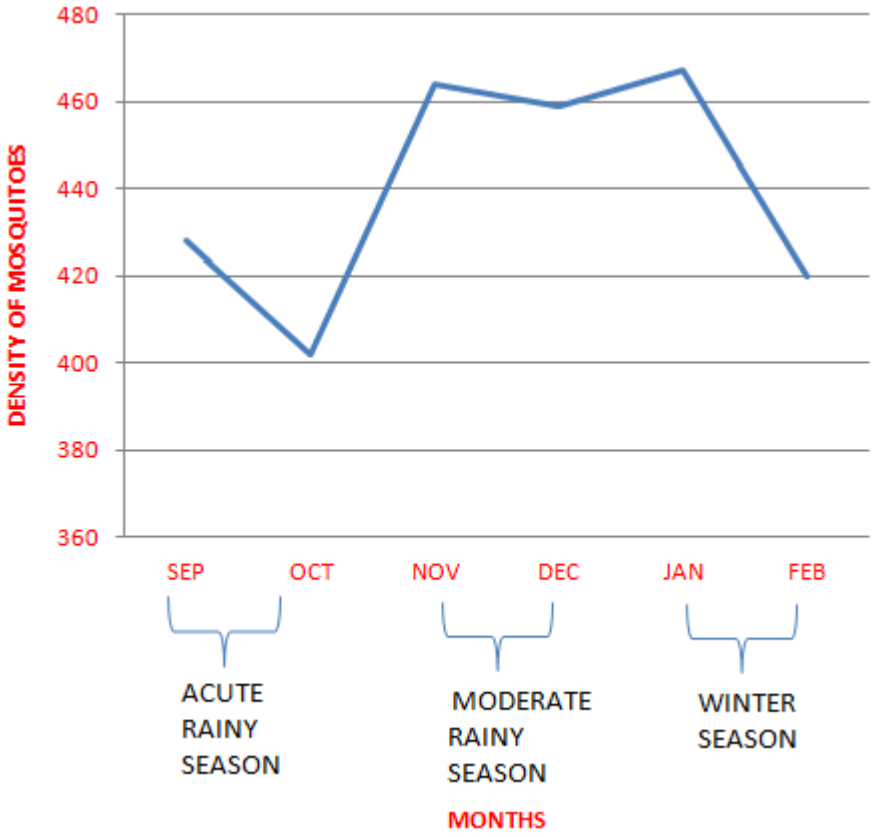


Fig 6: Seasonal variation in density of mosquitoes recorded in the study area during the study period (Sep 2009- Feb 2010)

Similar observation was reported by Burroni *et al.* [12] and Klinkenberg *et al.* [13] where the density was positively correlated with existence of artificial irrigation system and simultaneous plantation of paddy and other crops. From the data recorded in the study area variation in the density of pattern of occurrence of mosquitoes was observed. This was mainly due to the availability of breeding habitats in all seasons and formation of new breeding habitats during acute rainy season. That is rainfall was considered as the altering factor of mosquito density. Vargas and Vargas [14] reported that both diversity and density of mosquitoes increased with introduction of new irrigation projects and rainfall.

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