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Seasonal abundance and diversity of mosquito in different ecosystems of Annamalai Nagar, Tamil Nadu

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Abstract

A field survey conducted to evaluate the seasonal abundance, species diversity and identify potential breeding sites of mosquito in Annamalai Nagar municipality during August 2013 to May 2014 in the different ecosystem such as cesspit, cesspools, drains, septic tank, containers either man-made or natural, rice fields, rice pot culture and ponds of the following stations viz., Vadakiruppu, Therkiruppu, Sivan Koil Street, Thiruvedkalam, Tobacco Garden, Arumuganar Nagar, Mariyappa Nagar, Agriculture Faculty. Five mosquito genera recorded in the different stations and the genus *Culex* was recorded as predominant species in Annamalai Nagar at both rainy and non-rainy seasons. Cesspit, cesspool, drainage, septic tank and rice field were identified as potential breeding sites. The higher number of mosquito recorded from August to December and January to May.

Keywords: Mosquito, abundance, diversity, *Culex*

1. Introduction

Mosquitoes are a major public health problem in many countries of the world, they found in every region of the world except Antarctica. World health organization (WHO) has declared the mosquito as "Public enemy number one" because they transmit some of the world's most life-threatening and debilitating parasitic and viral diseases including Malaria (*Anopheles*), Filariasis (*Culex*, *Mansonia* and some *Anopheles* sp) and Dengue and Chikungunya fever (*Aedes aegypti*)^[1]. Vector mosquitoes, *Anopheles stephensi*, *Aedes aegypti*, *Culex quinquefasciatus* are the major urban vectors of malaria, dengue and lymphatic filariasis respectively. There is a need to know the mosquito species around us to take precautionary action against disease spread. The experiment aimed to identify the potential breeding sites, diversity and abundance of mosquito, in the different ecosystems of Annamalai Nagar in a different season.

2. Materials and Methods

2.1. Selection of stations for field Survey

The study area, Annamalai Nagar is situated in Northeast of Chidambaram, Tamil Nadu and located in plains at 11°24'N latitude and 79°44' E longitude at an altitude of +5.79 m above mean sea level. For the present study, the following stations were selected for the survey at Annamalai Nagar viz., Vadakiruppu, Therkiruppu, Sivan Koil Street, Thiruvedkalam, Tobacco Garden, Arumuganar Nagar, Mariyappa Nagar, and Agriculture Faculty. These stations were selected based on availability and non-availability of water bodies for the breeding of mosquitoes and the surveys were done both rainy and non-rainy seasons.

2.2. Identification of larval habitat and collection of the larva

All types of potential mosquito breeding sources in the study area were examined at random. This included cesspit, cesspools, drains, septic tank, containers either man-made or natural, rice fields, rice pot culture and ponds. The method adopted by^[2] was followed to collect the larvae from different habitats. To find out whether the habitat contained the larvae or not, first the water was collected with the help of white background spoon. If there are mosquito larvae in the sample water, the standard dipper of 250 ml capacity with 3 feet handle was used. One side of the dipper has a wire mesh through which water is filtered out and the larvae were retained inside. The collections were carried out twice a month.

Three dips were made in each spot. The collected larvae were placed in plastic containers and labelled. The nature of habitat, date and time of collection were noted. The larvae were identified at generic level. The identified larvae were discarded and the unidentified larvae reared in the laboratory for the confirmation of their generic name. The presence or absence of larvae and their abundance were noted.

2.3. Rearing of larvae for identification

The unidentified larvae were transferred into the enamel trays containing tap water. The larvae were fed with yeast tablet. The pupae were separated prior to emergence and kept into the cages. The emerged mosquitoes were collected by vials and killed by exposing them to chloroform. The mosquitoes were kept in different test tubes, which were marked for identification.

2.4. Identification

The mosquitoes collected during the adult stage and larval stages were identified at the Department of Zoology, Annamalai University. The distinguishing characters of every mosquito at genera level were noted.

3. Results and Discussion

3.1. Study of breeding habitats and resting places of vector mosquitoes at Annamalai Nagar

Different genera of vector mosquitoes showed variation in selection of breeding sites and resting places in both rainy and non-rainy season at Annamalai Nagar. An idea of this can be obtained from the varied larval habitat and resting places of the larval and adult mosquitoes respectively. The different breeding habitats such as cesspit, cesspool, drain, septic tank, container, pond, rice field and rice pot culture were observed in the different stations

Table 2: Collection of vector mosquitoes in different breeding habitats and resting places of Annamalai Nagar (Rainy season- Aug to Dec 2013)

| Genera | Breeding habitats of Annamalai Nagar | | | | | | | | | |
|------------------|--------------------------------------|----------|-------|-------------|-----------|------|------------|------------------|--------|---------|
| | Larval habitats | | | | | | | | Adult | |
| | Cesspit | Cesspool | Drain | Septic tank | Container | Pond | Rice field | Rice pot culture | Indoor | outdoor |
| <i>Culex</i> | X | X | X | X | --- | --- | X | --- | X | X |
| <i>Aedes</i> | --- | --- | --- | X | X | --- | --- | X | X | X |
| <i>Anopheles</i> | --- | --- | X | X | X | X | X | X | X | X |
| Others | X | --- | X | --- | --- | --- | --- | --- | X | X |

X: Present Absent

Table 3: Collection of vector mosquitoes in different breeding habitats and resting places of Annamalai Nagar (Non rainy season- Jan to May 2014)

| Genera | Breeding habitats of Annamalai Nagar | | | | | | | | | |
|------------------|--------------------------------------|----------|-------|-------------|-----------|------|------------|------------------|--------|---------|
| | Larval habitats | | | | | | | | Adult | |
| | Cesspit | Cesspool | Drain | Septic tank | Container | Pond | Rice field | Rice pot culture | Indoor | outdoor |
| <i>Culex</i> | X | X | X | X | --- | --- | --- | --- | X | X |
| <i>Aedes</i> | --- | --- | --- | --- | X | --- | --- | --- | X | X |
| <i>Anopheles</i> | --- | --- | --- | X | X | X | X | --- | X | X |
| Others | --- | X | X | --- | --- | X | --- | --- | X | X |

X: Present ---: Absent

Table 4: Immature and adult collections of vector mosquitoes in different stations at Annamalai Nagar (Rainy season- Aug to Dec 2013)

| Stations | Genera | | | | | | | |
|---------------------|--------------|-------|--------------|-------|------------------|-------|---------------|-------|
| | <i>Culex</i> | | <i>Aedes</i> | | <i>Anopheles</i> | | <i>Others</i> | |
| | Larva | Adult | Larva | Adult | Larva | Adult | Larva | Adult |
| Vadakiruppu | X | X | --- | X | --- | X | --- | --- |
| Therkiruppu | X | X | --- | --- | X | X | --- | X |
| Sivan Kovil Street | --- | X | --- | X | --- | --- | X | X |
| Thiruvudkalam | --- | X | --- | X | X | X | --- | X |
| Tobacco garden | X | X | --- | X | --- | --- | --- | X |
| Arumuganar Nagar | X | X | --- | --- | --- | X | X | X |
| Mariyappa Nagar | X | X | X | X | --- | --- | --- | --- |
| Agriculture Faculty | --- | --- | X | X | X | X | --- | --- |

X: Present Absent

like Vadakiruppu, Therkiruppu, Sivan Koil Street, Thiruvudkalam, Tobacco garden, Arumuganar Nagar, Mariyappa Nagar and Agriculture faculty at Annamalai Nagar (Table 1). The adult mosquitoes were collected during day and night time in indoor and outdoor resting places. The genera were specific to different stations of the Annamalai Nagar based on availability and non-availability of the breeding habitats and indoor and outdoor resting of the mosquitoes.

Table 1: Various breeding habitats found in different stations of Annamalai Nagar

| S. No | Station name | Breeding habitats |
|-------|---------------------|---------------------------------|
| 1 | Vadakiruppu | Drainage, Cesspit |
| 2 | Therkiruppu | Drainage, Septic tank |
| 3 | Sivan kovil street | Container, Drainage, Pond |
| 4 | Thiruvudkalam | Drainage, Container, Cesspool |
| 5 | Tobacco garden | Cesspool, Drainage, Septic tank |
| 6 | Arumuganar Nagar | Pond, Cesspit, Drainage |
| 7 | Mariyappa Nagar | Drainage, Container |
| 8 | Agriculture faculty | Rice field, Rice pot culture |

3.2. Identification of mosquito species at Annamalai Nagar

Survey results revealed that a total number of three vector mosquitoes (*Culex*, *Anopheles* and *Aedes*) genera and other mosquito genera including (*Armigeres* and *Mansonia*) were also identified from different ecosystems of Annamalai Nagar. The following observations like breeding habitats, identification of larvae in various breeding habitats and adult mosquitoes in indoor and outdoor resting places at the genus level (Table 2 and 3) and immature and adult collection of vector mosquitoes (Table 4 and 5) were made at both rainy and non-rainy season in following stations of Annamalai Nagar.

3.3. Generic diversity abundance in different stations

Among the vector mosquitoes collected during the study period, the genus *Culex* was the predominant species observed from all the eight different stations of Annamalainagar at both rainy and non-rainy seasons (Table 4 and 5). They preferred wide breeding habitats like cesspit, cesspool, drainage, septic tank, rice field (Table 2 and 3). The Dominance of genus *Culex* was due to availability of polluted water and stagnant water habitat with high organic content. The results are in tune with the findings of many researchers who had reported that *Culex quinquefasciatus* preferred habitats with turbid water resulting from the pollution with organic matter [3, 4]. Similar results were observed by [5] who found that *Culex* was the dominant and predominant species in Chidambaram area, Cuddalore district, Tamil Nadu. Further, *Culex quinquefasciatus* was found to be predominant species in North Coimbatore might be due to the presence of open sewage canals [6]. The Genus *Culex* was found in highly polluted urban habitats such as drainages [7, 8, 9], revealed that *Culex quinquefasciatus* breed in almost all kind of habitats and stagnant drains suitable for its regeneration. Rice fields were inhabited by *Culex* [10, 11, 12], observed that the incidence of *Culex quinquefasciatus* larvae was higher in all seasons indicating the higher abundance of this mosquito in the city areas.

In the present investigation, the genus *Anopheles* were collected and identified in both rainy and non-rainy seasons. They preferred breeding places of septic tank, containers, pond, rice field, rice pot culture in the study area of Annamalainagar. The results are corroborates with the findings of [13] who reported that temporary water bodies such as farm ditches, rain pools and open pits were most preferred habitats for Anopheline larvae. In 1989, [14] reported that temporary (hoof print, riverbed pools), semi-permanent (small pools, paddy fields, irrigation channels) and permanent (pond, river, wells and intra domestic sources) are the major breeding habitats of *Anopheles* mosquitoes. The result of the present study is coinciding with [15] who found that *Anopheles* species was able to adapt themselves to the various ecological circumstances provided by all stages of rice culture (nursery, watering, planting, growing, maturation, harvesting, land fallow, etc.). *Anopheles culicifacies*, the major vector of malaria in India was high during monsoon and post-monsoon season and rarely observed in pre monsoon or summer season

was reported by [16].

The genus *Aedes* were collected and identified in both rainy and non rainy seasons. The incidence of *Aedes* was more in rainy season as compare to non rainy season. They preferred breeding places of containers, septic tank and rice pot culture in the study area of Annamalainagar. The habitat preference by *Aedes* species was found to be the major breeding habitats of *Aedes* mosquitoes both natural and artificial containers such as temporary pools, cemented tanks, stream pools, tyres, tree holes, buckets, trashcans, planter dishes and traps [17]. The results are confirmed with the earlier findings by [18] found that artificial containers such as tyres, buckets, trashcans, planter dishes, traps and natural tree holes are the major breeding habitats of *Aedes* mosquitoes. Further, [19] described an *Aedes aegypti* an urban mosquito that breed almost entirely in manmade containers found in and around households, construction sites, factories etc, and larval population was recorded in drains, pits, streams, canals, containers and tree holes. *Aedes* mosquitoes were found to be maximum in the month of September which was at par with the findings of other workers in north eastern climate [20] and reported the higher dengue transmission in post monsoon (September-December).

It was observed that the genus, *Mansonia* was identified from pond whereas *Armigeres* was identified from the cesspool and drainage. Genus *Mansonia* eggs were laid on or under the surface of floating leaves of aquatic plants [21]. He also suggested that larvae were found in association with many types of water plants both floating and fixed to the bottom. Larval habitats are usually permanent and semi permanent swamps and water holes. According to [22] suitable breeding habitats for *Armigeres* are water bodies often polluted and closely associated with human habitation. The highest numbers of mosquito genus were recorded invariably in August to December and January to May which might be due to prevailing monsoon pattern in the study area. The results are contrary to the report by [23] who found that highest number mosquitoes was found during summer and autumn and less number during winter and early spring. Similar observations were also observed by [24] who recorded highest numbers of species during early summer especially in June, with the total number of adults collected were increasing from June to September and decreasing in October.

Table 5. Immature and adult collections of vector mosquitoes in different stations at Annamalainagar (Non rainy season- Jan to May 2014)

| Stations | Genera | | | | | | | |
|---------------------|--------------|-------|--------------|-------|------------------|-------|---------------|-------|
| | <i>Culex</i> | | <i>Aedes</i> | | <i>Anopheles</i> | | <i>Others</i> | |
| | Larva | Adult | Larva | Adult | Larva | Adult | Larva | Adult |
| Vadakiruppu | X | X | --- | --- | --- | --- | --- | --- |
| Therkiruppu | X | X | --- | --- | X | --- | --- | --- |
| Sivan Kovil Street | --- | X | X | X | --- | --- | --- | X |
| Thiruvudkalam | X | X | --- | X | X | X | --- | --- |
| Tobacco Garden | X | X | --- | --- | --- | --- | --- | --- |
| Arumuganar Nagar | --- | X | --- | --- | X | X | X | X |
| Mariyappa Nagar | X | X | --- | --- | --- | --- | --- | --- |
| Agriculture faculty | --- | --- | --- | --- | --- | --- | --- | --- |

X: Present; Absent

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