DIVERSITY OF ANOPHELES SPECIES IN ERODE DISTRICT

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ABSTRACT

Insects are the only invertebrates to have evolved flight. Insects are the most diverse groups of animals on the planet. The Diptera are the most diverse. They have an immense potentiality for rapid increase and are known to spread diseases such as malaria, yellow fever and dengue. The genera Anopheles is dangerous because it transmits malaria. The total number of global cases of vector borne diseases every year is approximately 1 billion. In the present study totally six species of Anopheles mosquitos were collected from different larval habitats including agro ecosystem.

KEYWORDS: Diptera, Dengue.

INTRODUCTION

Insects are the only invertebrates to have evolved flight. Insects are the most diverse groups of animals on the planet, including more than a million described species and representing more than half of all known living organisms (Chapman, 2006; Wilson, 2009). Complete metamorphosis is unique to a group of certain insect orders including Diptera.

The Diptera are the most diverse insect order and mosquitoes (Culicidae) belong to the order diptera. The vast majority of lower diptera have larvae and pupae that are aquatic or semi-aquatic (Foote, 1987; Brown, 2001; Meritte et al., 2003). They have an immense potentiality for rapid increase and are known to spread diseases such as malaria, yellow fever and dengue. However, these species, which are largely confined to the Genera Aedes, Anopheles, and Culex. Mosquitoes are vectors of a number of agents including malaria, yellow fewer, filariasis, dengue, dog heart worm, the encephalitis and related viral diseases. Climate change parameters like temperature, rainfall, humidity and other parameters also have an impact on
mosquito population, diversity and diseases transmission (Reiter, 2001; Sutherst, 2004). The total number of global cases of vector borne diseases every year is approximately 1 billion. Mosquitoes are considered the deadliest animal in particular, the Anopheles mosquito is dangerous because it transmits Malaria. For malaria alone, a staggering 300-500 million people are infected and 1.0-1.5 million people die every year and an African child dies from malaria every 30 seconds (WHO, 2007). The frequency of mosquito transmitting diseases increases due to major ecological changes in the India. It has been reported that deforestation, industrialization, agriculture, migration of populations, new settlements, population explosion, new settlements, non-planned urbanization and unplanned garbage management in the last two decades (Malhotra and Mahanta, 1994).

However, according to the malaria report 2013, Plasmodium vivax develops in Anopheles mosquito, at wider temperature ranges. Outbreak of Japanese Encephalitis, Malaria and Dengue may be facilitated by two factors i.e., global climate change and the modulation of agricultural practices. Mosquito borne diseases currently represent greater health problems in tropical and subtropical countries. This study was carried out in Erode District, Tamil Nadu to identify the larval habitats and diversity of Anopheles mosquito which is the major vector for malaria.

MATERIALS AND METHODS
Erode District is extended between 10-35' and 11-60' of north latitude and 76.49' and 77.58' of East longitude. Urban, rural and forest fringes were chosen for mosquito collections and random collections were also done from other areas. Oral aspirator, mechanical aspirator and sweep nets were used for adult mosquito collection. The study carried out from 2012-2013 to 2013-2014. Collection were done during Dawn and Dusk. The standard dipper 400ml (WHO, 1975) was used for the collection of the mosquito larva.

Mosquitoes were anesthetized with ethyl acetate and mounted on a minute pin under a binocular stereo microscope. Adults collected in the field were assigned the code RC (Resting Collection) and numbered on pinning as RC1, RC2, RC3, etc., with the date of collection, collection site and habitat. Larval samples were maintained separately with a code number. Larval skin of fourth-instar larvae were removed and preserved in 70% alcohol with the respective code numbers for slide mounts for identification by using Hoyer’s medium (Belkin, 1962). Collected specimens were identified in Vector Control Research Centre,

**PHYSICOCHEICAL ANALYSIS**

Thermometer was used for recording temperature, pH and TDS were recorded with the help of Digital meter. The standard method “Water and Waste Water Analysis” by APHA (2005) was used for Salinity analysis.

**DIVERSITY INDEX**

The diversity of the collected mosquitoes were statistically assessed by using Shannon-Weiner index, Simpson’s index, Pielou’s Evenness, Dominance and Margalef’s Index were calculated by the software PAST 3.x (version 2013).

**RESULTS AND DISCUSSION**

The diversity of mosquitoes in the study area shows the availability of breeding habitats, resting places and favourable climatic factors like temperature and rainfall. A total of six species *Anopheles nigerrimus, Anopheles peditaeniatus, Anopheles culicifacies, Anopheles stephensi, Anopheles subpictus and Anopheles vagus* were collected during the study period. *Anopheles* species are vectors of malaria and were collected in various natural breeding sites like paddy fields, harvested paddy fields, ground pool, river bed pool, seepage and stagnant waters. In India and its neighboring countries, the biology of Anopheline mosquitoes, particularly malaria vectors has been studied extensively (Rao, 1981). The agro-eco system favours high degree of diversity and provide ideal conditions for Anophiline mosquitoes. Continues water management in the rice fields enriched mosquito population. *An.culicifacies* larvae were collected during the first month. But *An.subpictus* larvae were found only in the second month from the rice fields. During the study period paddy field water temperature, pH, TDS and Salinity ranges between 28.6-30°C, 7.1-7.36, 273-386mg/l and 0.40-0.74 ppm.

Spread of Nitrogenous fertilizers enriches mosquito larval population in rice fields (Simpson and Roger, 1991) Paddy cultivation and irrigation system provide a suitable source of breeding places of mosquitoes (Kanojia et al., 2003). In South Korea, Anopheline species were found associated with flooded rice fields (Sithiprasana et al., 2005). Addition of Nitrogenous fertilizers after few days after transplantation attracts *Anopheles* and Culicine mosquitoes for oviposition (Sanford et al., 2005). Adults of *An.peditaeniatus* were collected near the paddy fields. Shannon index recorded for *An.peditaeniatus* was 2.23 and Richness
An. culicifacies was reported from domestic well and pits used for plantation of coconuts (Rajendran et al., 1986). However, in the present study An. culicifacies was collected from different habitats like river bed pool, ground pool, stagnant and seepage pools. Temperature of the habitats ranges between 24.75±1.70-26.45±3.10, and pH recorded was 6.9±0.08-7.06±0.12. TDS levels of breeding habitats was 154.21±53.21 - 485.23±56.73 and salinity of the habitats ranges between 0.08±0.01 - 0.79±0.09. Devi and Jauhari, (2004) reported An.culicifacies, An.fluviatilis, An.annularis and Cx.quinquefasciatus from seepage water in India. An.culicifacies found in this study is the major rural malarial vector in India (Khan et al., 2014). Diversity indices shows Shannon’s index 2.127 and richness 1.766 for An.culicifacies (Table 2).

An. stephensi breeds in all sources of larval breeding habitat even in water pools used for building constructions. In rural areas Manoucheri et al., (1976) found this species in different water bodies’ like stream beds, palm irrigation canals, margin of river beds and seepages. Malaria vector An.stephensi was addressed from different parts of India (Hati et al., 1992; Sharma et al., 1993). In the present study immatures of An.stephensi were collected from the river bed areas with temperature of 26.45±3.10, pH 6.9±0.10, TDS 154.21±53.21 and salinity 0.08±0.01. Likewise in Southern Iran, Hanafi – Bojd et al., (2012) also reported An.stephensi from river with sandy bed areas. Attaullah et al., (2015) recorded An.stephensi adults from the poultry farms in rural areas. Similarly, adults of An.stephensi were collected from cattle sheds and poultry farms during the period of study. Recorded Shannon’s index was 2.215 and Marglef’s richness was 2.078 for these species.

During the present study An.subpictus was reported from natural habitat river bed pool with temperature of 26.45±3.10, pH 6.9±0.10, TDS 154.21±53.21 and salinity 0.08±0.01. An.subpictus is a vector for human filariasis and considered as non-vector (Raghavan, 1969). Devi and Jauhari, (2004) reported this species from paddy field, seepage and streams. It is also recorded from paddy fields, ground pool, tree hole and broken pot by Chandrasekar et al., (2012) in Tamil Nadu and Balasubramanian and Nikhil, (2013) in Kerala. Shannon’s index 2.092 and Marglef’s richness was 1.896 for An.subpictus. The study An.nigerrimus adults were collected from cattle sheds. Shannon index and Richness recorded for An.nigerrimus was 2.23 and 2.084. In India and Indonesia An.nigerrimus was recognized as a vector for human filariasis (Sathish Kumar and Vijayan, 2005). Sahu et al., (2008) reported...
An.vagus from cattle sheds and human dwellings. This findings were corroborated with the present work and An.vagus was collected from cattle sheds. Shannon index 2.142 and Richness 1.777 was recorded for An.vagus. In Erode, Tamil Nadu Rajeswari et al., (2017) documented six mosquitoes species belonging to the genus Anopheles (26.27%) in different aquatic habitats and from cattle sheds. Agro-eco system and rain fall enriches the breeding habitats of Anopheles mosquitoes. During the rainy season number of species recorded were high than the other seasons. Rain fall produces new breeding habitats in the study area. The current results are reliable with Sahu et al., (2011) who recorded highest density of An.minimus and An.fluvatilius during rainy season.

TABLE 1: MEAN VALUES OF PHYSICOCHEMICAL PARAMETERS DURING THE STUDY PERIOD.

<table>
<thead>
<tr>
<th>S.No</th>
<th>SPECIES</th>
<th>Individuals</th>
<th>Temperature °C</th>
<th>pH</th>
<th>TDS(mg/l)</th>
<th>Salinity(ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An. nigerrimus</td>
<td>196</td>
<td>24.75±1.70</td>
<td>7.06±0.12</td>
<td>243.68±115.89</td>
<td>0.54±0.11</td>
</tr>
<tr>
<td>2</td>
<td>An. peditaeniatus</td>
<td>187</td>
<td>26.45±3.10</td>
<td>6.9±0.10</td>
<td>154.21±53.21</td>
<td>0.08±0.01</td>
</tr>
<tr>
<td>3</td>
<td>An. culicifacies</td>
<td>288</td>
<td>25.45±2.50</td>
<td>7.05±0.05</td>
<td>485.23±56.73</td>
<td>0.79±0.09</td>
</tr>
<tr>
<td>4</td>
<td>An. stephensi</td>
<td>199</td>
<td>25.35±2.00</td>
<td>6.9±0.08</td>
<td>349.91±93.32</td>
<td>0.27±0.06</td>
</tr>
</tbody>
</table>

TABLE 2: ALPHA DIVERSITY INDEX OF MOSQUITO SPECIES.

<table>
<thead>
<tr>
<th>S.No</th>
<th>SPECIES</th>
<th>Individuals</th>
<th>Dominance</th>
<th>Simpson _1-D</th>
<th>Shannon_H</th>
<th>Evenness_e^H/S</th>
<th>Margalef</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An. nigerrimus</td>
<td>196</td>
<td>0.1462</td>
<td>0.8762</td>
<td>2.23</td>
<td>0.7751</td>
<td>2.084</td>
</tr>
<tr>
<td>2</td>
<td>An. peditaeniatus</td>
<td>187</td>
<td>0.113</td>
<td>0.887</td>
<td>2.289</td>
<td>0.8966</td>
<td>1.902</td>
</tr>
<tr>
<td>3</td>
<td>An. culicifacies</td>
<td>288</td>
<td>0.1395</td>
<td>0.8605</td>
<td>2.127</td>
<td>0.7629</td>
<td>1.766</td>
</tr>
<tr>
<td>4</td>
<td>An. stephensi</td>
<td>199</td>
<td>0.1291</td>
<td>0.8709</td>
<td>2.215</td>
<td>0.7637</td>
<td>2.078</td>
</tr>
<tr>
<td>5</td>
<td>An. subpictus</td>
<td>195</td>
<td>0.148</td>
<td>0.852</td>
<td>2.092</td>
<td>0.7364</td>
<td>1.896</td>
</tr>
<tr>
<td>6</td>
<td>An. Vagus</td>
<td>278</td>
<td>0.137</td>
<td>0.863</td>
<td>2.142</td>
<td>0.7742</td>
<td>1.777</td>
</tr>
</tbody>
</table>

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