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Research Article

Survey and Identification of Mosquito Species in and Around Chennai

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Abstract

Mosquitoes are the most important vectors since they cause the highest number of human deaths every year. They are important etiological agents of infections to human beings and native faunas. Japanese encephalitis, filariasis, dengue, malaria, dengue hemorrhagic fever, yellow fever, zika and chikungunya are some of the major diseases caused by mosquitoes. Mosquito-borne diseases have become more life threatening and widely dispersal due to ecological and environmental changes, development of urbanization and invasion of insect pests. This research focuses on the biodiversity of mosquitoes present in districts of Chennai. Larvae and adult mosquitoes from 12 Taluks of Chennai were collected manually and were maintained and cultured under laboratory conditions. The larvae were fed with dog biscuit and Brewer's yeast (3:2), the adults were fed with Sucrose (10%) solution in a jar with a cotton wick. F2 generations were used for morphological characterization and identification. *Aedes albopictus, Armigeres subalbatus,* and *Culex quinquefasciatus* were identified and documented.

Keywords: Vector; Mosquitoes; *Aedes albopictus; Armigeres subalbatus; Culex quinquefasciatus*; Morphology

Abbreviations

WHO: World Health Organization; ERI: Entomology Research Institute; Ta: Tarsomere; Te: Terga; C: Coxa; Fe: Femur

Introduction

Death toll across the globe is rapidly increasing due to diseases that are spread through mosquitoes. In the Linnaean classification, mosquitoes belong to the Phylum Arthropoda, Class Insecta, Order Diptera, Suborder Nematocera and Family Culicidae. Across the world, there are more than 3500 mosquito species which are identified and listed [1]. However, among all these identified mosquitoes, little more than 100 species are studied to be important vectors that are the causative agent for the spread of mosquito borne diseases [2,3]. Hence World health Organization has declared mosquitoes as public enemy number one [4]. India which is a homeland for diverse flora and fauna species, is also native to vector mosquito belonging to the *Aedes, Anopheles,* and *Culex* genera [5,6]. From these genera different species like *A. aegyptii*, *A. albopictus*, *A. stricticus, A. cinereus, Anopheles stephensi, Culex quinquefasciatus* and *Mansonia* spp. cause serious nuisance to humans and animals.

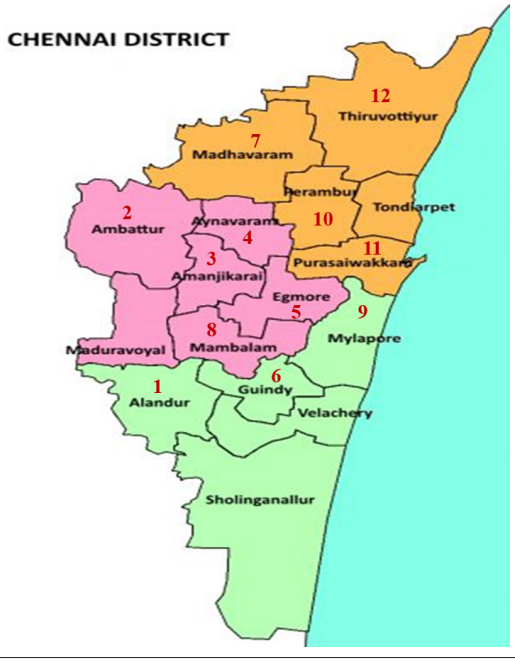
Vector mosquitoes mainly transmit diseases like malaria, dengue, dengue hemorrhagic fever, Japanese encephalitis, filariasis, yellow fever, chikungunya, zika virus and West Nile virus [5,6]. These tiny hematophagous insect vectors have a great impact on public health, labour outputs and economic burden as well [7]. Although mosquitoes have been studied more extensively than any other insects, their taxonomical and phylogenetic knowledge is far from complete. Newer species are being identified year after year. This research aims at the survey and identification of mosquito species in and around Chennai and documenting them based on the morphological characteristics.

Materials and Methods

Collection of mosquitos

Mosquitoes were collected from 12 Taluks of Chennai, Tamil Nadu, India between October-December, 2019. The larvae were collected from stagnant water using a fresh Stainer (net trap) and were preserved in the plastic containers containing fresh water. The adult mosquitoes were collected by hand pick method and preserved in 70% ethanol in Eppendorf tube for the morphological study. The adult mosquitoes were preserved at Entomology Research Institute (ERI) for morphological identification, while the larvae were reared under laboratory conditions at ERI (F2 generation) (Table 1).

Table 1: Map of Chennai district and places of mosquito collection (numbered places).

S. No.	Places of Mosquito Sampling	Map of District (Chennai)
1.	Alandur	
2.	Ambattur	
3.	Aminjikarai	
4.	Ayanavaram	
5.	Egmore	
6.	Guindy	
7.	Madhavaram	
8.	Mambalam	
9.	Mylapore	
10.	Perambur	
11.	Purasawalkam	
12.	Tiruvottiyur	

Rearing of immature mosquito stages

The laboratory hatched larvae from the field collected adult mosquitoes were introduced into enamel trays containing faucet water. The larvae were kept free unfastened from pathogens, repellents or pesticides and were fed with dog biscuit and Brewer's yeast (3:2). Then pupae were collected and transmitted from the trays to a cup containing tap water and was placed in screened cages (23×23×32 cm in dimension) for adult emerging. Sucrose (10%) solution was provided in a jar with a cotton wick for adult mosquitoes. Adult mosquitoes will be deprived of sucrose for 12 hours after which they were provided with a membrane blood feeding. After 3 days, the ovitrap was kept inside the cages and maintained at 28 ± 1 °C temperature at 65-70% relative humidity.

Morphological identification

Morphological identification was done by observing the morphology of the collected and reared mosquitos. The parts of mosquitos such as proboscis, thorax, legs and abdomen were clearly observed and the mosquito species was identified using standard taxonomical keys.

Results

The mosquitoes collected from different taluks of Chennai were identified based on their morphological features. The identified species are as follows. Different mosquito samples were collected from 12 taluks of Chennai. Morphological identification resulted in three main species namely *Armigeres subalbatus, Culex quinquefasciatus* and *Aedes albopictus* (Table 2).

S. No.	Area of Mosquitoes collected	Species
1.	Alandur	*Armigeres subalbatus, Culex quinquefasciatus Aedes albopictus*
2.	Ambattur	*Culex quinquefasciatus*
3.	Aminjikarai	*Armigeres subalbatus,*
4.	Ayanavaram	*Culex quinquefasciatus*
5.	Egmore	*Armigeres subalbatus, Culex quinquefasciatus*
6.	Guindy	*Armigeres subalbatus,*
7.	Madhavaram	*Culex quinquefasciatus*
8.	Mambalam	*Culex quinquefasciatus Aedes albopictus*
9.	Mylapore	*Armigeres subalbatus,*
10.	Perambur	*Culex quinquefasciatus Aedes albopictus*
11.	Purasawalkam	*Armigeres subalbatus,*
12.	Tiruvottiyur	*Culex quinquefasciatus*

Table 2: Species of Mosquitoes collected from different Taluks.

- ***Aedes albopictus:*** Proboscis entirely dark-scaled; palpus with white scales at apex; pedicel with scales on lateral surfaces.
- **Thorax:** Scutum with median longitudinal stripe; antealar area with patch of broad pale scales; mesepimeron with lower scales; paratergite with scales; postpronotal scales present; post spiracular scales absent; proepisternal scales present; scutal angles without pale scales; sub spiracular area with broad white scales.
- **Legs:** Silvery or white scale patches on legs; Ta-I–III$_{1–5}$ with only basal bands.
- **Abdomen:** Tergal scales basal, often not connected with lateral pale scales; I-Te without median patch of white scales.
- ***Armigeres subalbatus:*** Proboscis curved downward and laterally compressed; eyes ventrally with 2 rows of scales.
- **Thorax:** Scutum without pair of sub median golden stripes, lateral margins with complete line of pale scales; prescutellar setae present; post spiracular setae present; lower anterior mesepimeral seta present.
- **Abdomen:** Terga with lateral pale patches not extending dorsally; III–VI-S with apical dark bands.
- **Legs:** Fe-III posteroventral surface with broad white band extending to or nearly to apex.
- ***Culex quinquefasciatus:*** Proboscis without distinct median pale band.
- **Thorax:** Post spiracular scales absent; prealtar scales absent; lower mesepimeron with one seta; C-I with a few dark scales; scutal integument yellowish or pale brown.
- **Legs:** Ta-I–III entirely dark. Anterior surface of Fe-I, Fe-II and Ti-I–III without median longitudinal pale stripes.
- **Wings:** Wing entirely dark-scaled; vein R_{2+3} short, <0.25 length of cell R_2.
- **Abdomen:** Terga bands with pale yellowish basal bands; abdominal sterna not banded.

Discussion

Mosquitoes could be identified at various levels. However, this is not an easy process. The eggs could be identified using microscope. Eggs of Culicine mosquitoes (e.g. *Culex* and *Aedes*) are usually elongate-oval in shape with the anterior end rounded and the posterior bluntly pointed. Anopheline eggs (e.g. Anopheles) are more cigar-shaped with flotation structures on each side [8].

Identification of larvae is most easily accomplished with mature larvae, i.e. the fourth instar and microscopic examination is usually required. *Anopheles* species lack a siphon and larvae lie flat at the surface of the habitat. *Culex* and *Aedes* species have siphons and hang suspended from the surface. Culex species typically have longer siphons than Aedes species (Sanchez-Ortiz., *et al*. 2017).

Identification of adult mosquitoes is very complex, even to genus level microscopes are required. However, the sex of mosquitoes caught in the field can often be determined by eye, if they stop flying around for a second! Adult males differ from females in that they have long palps protruding from their head next to their proboscis, and very bushy antennae compared to those of the females. An exception to this occurs in the Anopheles genus, which has both sexes with long palps, but the males still have the bushier antennae [9,10].

Conclusion

In the current study, we have collected mosquitos from 12 different taluks of Chennai to identify them. As the result, we have identified three different genera of mosquitos. Through this, we can

control the emergence of various vector-borne diseases transmitted by mosquitos. By knowing the predominance of particular species in an area, we would be able to eradicate the mosquito-borne diseases.

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