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Survey of container breeding mosquito larvae (Dengue vector) in Tiruchirappalli district, Tamil Nadu, India.

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ABSTRACT

Dengue is currently one of the most important arboviral diseases, with 2.5 billion people living in areas of risk and many millions of cases occurring each year. A prospective study was carried out in survey of container breeding mosquito larvae and identifying the dengue vector (*Aedes* species) distributed throughout Tiruchirappalli district, Tamilnadu, India. *Aedes* mosquito larvae were collected randomly during September 2012 to March 2013 from different natural and artificial containers and the water container index (CI) was calculated. Totally 118 water containers were inspected, among which 38 containers were recorded as positive for dengue vector. The collected larvae were raised to adults for identification. The dengue vector survey reveals the presence of two dominant mosquito species namely *Aedes aegypti* (45%) and *Aedes vittatus* (45%). Our study concludes that the *Aedes aegypti* and *Aedes vittatus* was most predominant container breeding mosquito in Tiruchirappalli district. Thus the study reveals the mosquito breeding habitat identification is helpful in creating of awareness and control of mosquito borne disease like dengue.

Keywords: *Aedes aegypti, Aedes vittatus,* Container vector, Dengue, Larvae, Mosquito.

1. Introduction

Dengue is considered as a serious public health problem with about 2.5 billion people at risk globally, of which a few may progress to dengue haemorrhagic fever (DHF) / dengue shock syndrome (DSS), the major cause of mortality mainly among infants[1]. In India, DF and DHF has been documented in different parts of the country[2] including southern India[3, 4].

The population of *Ae. aegypti*, fluctuates with temperature, rainfall and humidity. Dengue infections were generally encountered during or after rainfall, as an outcome of rise in vector population[5]. Among the thirteen genera of the family Culicidae, genus *Aedes* are considered dangerous because of their significant public health threat all over the world. One of the dominant species of *Aedes* showing wide geographic distribution and spanning both temperate and tropical climate zones is *Ae. aegypti*.

The problem of dengue has now been extended to newer areas including several rural areas. Of the 30 districts in Tamil Nadu, dengue cases have been reported from 29 districts between 1998 and 2005 which includes DSS/DHF outbreaks in Chennai[4] in 2001, Nagercoil and Tiruchirappalli in 2003 and DHF outbreaks in Krishnagiri and Dharmapuri districts[6] in 2001. In 2012, a total of 9,000 cases and 50 deaths were reported in Madurai, Tirunelveli and Kanyakumari districts[7]. Tiruchirappalli district is endemic for dengue and there has been no systematic study of vector and non-vector mosquito fauna carried out. Hence in the present study the mosquito larval survey was performed in container water in Tiruchirappalli district to investigate the distribution dynamics of dengue vector.

2. Materials and methods

2.1 Study Area

The mosquito larval survey was conducted from September 2012 to March 2013 in Turaiyur, Thottiyam, Musiri, Mannachanallur, Manaparai and Vaiyampatti in Tiruchirappalli district, (10° 47′ 40.56″ N, 78° 41′ 6″ E) Tamil Nadu, India. Tiruchirappalli district lies at the heart of Tamilnadu. The district has an area of 4,404 square kilometers. It is bounded in the north by Salem district, in the northwest by Namakkal district, in the northeast by Perambalur district and Ariyalur district,

in the east by Thanjavur district, in the southeast by Pudukkottai district, in the south by Madurai district and Sivaganga district, in the southwest by Dindigul district and, in the west by Karur district. Kaveri river flows through the length of the district and is the principal source of irrigation and water supply.

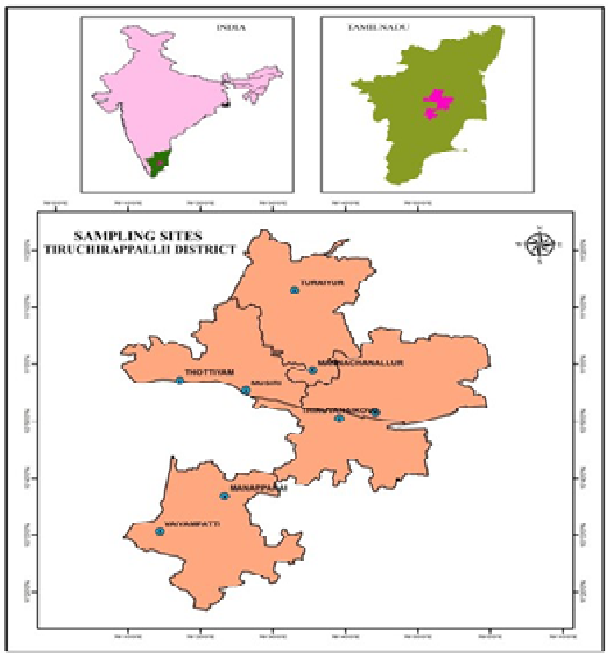

Fig 1: Sample collection sites

2.2. Larval Collection

During the survey, all the containers and reachable tree holes. Larvae collection was carried outdoors by dipping, using pipette or dipper depending on container type and location. In this study, "outdoor" refers to the outside of building but confined to its immediate area. The number, type and water condition of containers which serve as a potential breeding site was examined and recorded using container index (CI).

$$\text{Container index} = \frac{\text{Number of container positive}}{\text{Number of container inspected}} \times 100$$

The collected larvae and pupae were kept in the laboratory for adult emergence. The emerged adult mosquitoes were then pinned and identified.

Fig 2: Mosquito larvae breeding in various habitats

a.) Cement cistern, b.) Plastic container, c.) Metal vessels, d.) Waste tyre, e.) Mud pot, f.) Cement tank

2.3. Identification of Collected Larvae

The collected specimens were preserved in plastic vials for further identification. Immature forms of mosquito larvae were collected by dipper method[8], reared in metal trays in the laboratory and fed with larval feed. The emerged adults were collected and stored in vials and all the collected mosquitoes were identified in Centre for Research in Medical Entomology (CRME), Madurai using the standard keys[9].

3. Results

Totally 118, both artificial and natural containers were surveyed as potential mosquito larvae breeding habitats in Tiruchirappalli district, Tamil Nadu presented in Fig. 1. Among them, 38 containers were found positive, in which, 4 plastic containers, 16 cement cisterns, 6 waste tyres, 7 mud pots, 2 metal vessels, 2 tree holes and 1 unused well were containing mosquito larvae presented in Fig. 2. The outdoor environment was found to be the best breeding habitats for mosquitos because of filling of the containers with the rain water and storage of water in cement cisterns, and plastic drum by the people. Some of the peridomestic containers like mud pot, grinding stones, metal container, tyre and unused well were also surveyed.

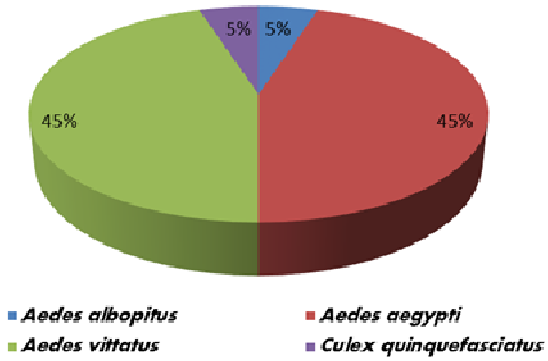

Fig 3: Distribution of Mosquito species population in Tiruchirappalli district

Among all type of containers surveyed, cement cistern (59.25%), mud pot (53.84), tyre (42.85), unused well (33.33), plastic container and vessels (25%) were positive for the mosquito larvae. The collected mosquito larvae included *Ae. albopictus* (5.26%), *Ae. aegypti* (44.73%), *Ae. vittatus* (44.73%) and *Cx. quinquefasciatus* (5.26%) presented in Table 1 and Fig. 3. Our study clearly indicates that *Ae. aegypti* and *Ae. vittatus* larvae were found in wide range in artificial containers like cement cistern and mud pot. *Cx. quinquefasciatus* were collected from unused well and mud pot containing high organic matter and *Aedes albopictus* were found in the waste tyre and tree holes.

The morphology and taxonomy of the adult mosquitoes were identified based on the examination of the taxonomic keys. *Aedes* adult mosquito has exposed patterns of the thorax formed by black, white or silvery scales. The legs were often black with white rings. The morphological identification of *Ae. aegypti* showed the presence of mesonotum marked with a pair of lateral curved white lines usually with a pair of sub median yellowish line, tibiae without rings and two dots of white scales on clypeus.

Aedes albopictus is another important dengue vector in rural areas. These species showed a narrow median silvery white line in mesonotum. The pleurae were arranged in irregular patches with white lines and tibiae without white line. These characters confirm the species of *Ae. albopictus*. The *Ae. vittatus* revealed 4-6 small white spots on the mesonotum and tibiae with white rings.

Culex quinquefasciatus is a filariasis vector and the external morphology was observed by following characters. The proboscis was without pale band. Legs were dark brown and pale posteriorly. The hind femur was with pale stripe on anterior surface and narrow pale band in abdominal tergite segments. Tarsal segments were without basal pale bands.

Table 1: Distribution of container breeding habitat of mosquito larvae in Tiruchirappalli district

Type of container	No. of container survived	No. of positive container		Species of mosquito larvae							
				Ae. albopictus		*Ae. aegypti*		*Ae vittatus*		*Cx. quinquefasciatus*	
		N	%	N	%	N	%	N	%	N	%
Plastic container	16	4	25	-	-	2	5.26	2	5.26	-	
Cement cistern	27	16	59.25	-		8	21.05	10	26.31	-	-
Waste tyre	14	6	42.85	1	2.63	2	5.26	2	5.26	-	-
Mud pot	13	7	53.84	-	-	4	10.52	2	5.26	1	2.63
Overhead tank	8	-	-	-	-	-	-	-	-	-	-
Vessels	8	2	25			1	2.63	1	2.63	-	-
Coconut shell	12	-	-	-	-	-	-	-		-	-
Polythene sheet	5	-	-	-	-	-	-	-		-	-
Tree hole	12	2	16.66	1	2.63	-	-	-		-	-
Unused well	3	1	33.33	-		-	-	-	-	1	2.63
Total	**118**	**38**	**32.20**	**2**	**5.26**	**17**	**44.73**	**17**	**44.73**	**2**	**5.26**

N = number of container, - = Nil

4. Discussion

Aedes aegypti is the principle dengue vector of urban areas[10]. The larvae of *Cx. quinquefasciatus* were collected more in number and they usually breed in stagnant and polluted water with high organic contents which placed *Cx. quinquefasciatus* as a non-forest species and anthropophilic nature[11, 12, 13]. The results of this effort prompted a revision of the keys of Darsie & Samanidou-Voyadjoglou[14]. The revised keys including some new anatomical characters were observed to aid both specialists and non-specialists in the identification of mosquitoes. The provided keys were regarded as preliminary, because of the availability of very few specimens for determining the reliability of all the characters.

Water-holding containers are the main larval habitats for *Aedes* mosquito. The quality of water as well as conditions of water containers, seemed to contribute to the abundance of *Aedes* species in the study site. Besides, water chemistry of aquatic habitats may also play a critical role in determining the survival rate of mosquitoes. The ability of gravid mosquito females to distinguish among potential oviposition sites that will or will not support the growth, development and survival of their offspring are critical to the maintenance of the mosquito population[15]. The rapid spread of *Aedes* sp. in Tiruchirappalli district was due to the storage of water in cement tanks and plastic container. From this investigation, it is clear that there are many chances of mild dengue viral infection spreading in the sampling location.

The source reduction is an effective way for the community to manage the populations of many kinds of mosquitoes[16]. The eradication of mosquito breeding containers or breeding sites in and around living, working areas should be taken into consideration, since the presence of water in containers is probably the most important factor in determining the breeding of mosquitoes, especially *Aedes* sp. and *Culex* sp. As a result, a mosquito control programme should be established at Tiruchirappalli district. Such a programme would reduce the risk to both animals and humans, and hence prevent the development of disease motivations in surrounding locations.

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