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A note on the observation of shift in the dengue season in Tamil Nadu, India

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Abstract
Entomological observation in Theni district was initiated taking cognizance of the ongoing epidemic during the month of February 2015 in the blocks like Aundipatti, Periyakulam, Theni, Bodinayakanur, Chinnamanur and Cumbam. Among the positive containers, cement cisterns (21.35%), plastic containers (19.1%), plastic drums (17.98%), cement tanks (16.85%) and the metal containers (12.36%) were the major breeding containers contributing to the dengue vectors. Indoor containers outnumbered the outdoor containers in these areas. The principal dengue vector is *Aedes aegypti* only. Many places in Tamil Nadu deficit in the rainfall which reduces drinking water supply and the people are forced to store water in open containers. In Tamil Nadu most of the dengue cases were reported during Northeast monsoon and hardly there were any cases in winter season, but this outbreak occurred only during the winter season (January-February). Moreover this outbreak was recorded both in the urban and rural environment of Theni district. Source reduction is an astounding task to be carried out in the water starved Aundipatti region and rural areas compared to the urban areas. Since there is a shift in the dengue prevalence to the winter season this year 2015, establishment of routine permanent dengue surveillance system both in the urban and rural agglomerations is the only solution to detect and reduce the further emergence of this dreaded disease.

Keywords: Dengue, *Aedes aegypti*, source reduction, container breeding

1. Introduction
Dengue fever (DF) is an important arthropod-borne viral infection which may lead to life-threatening Dengue hemorrhagic fever (DHF) which has no specific vaccines or therapeutics. Owing to its rapid emergence and global spread, a global strategy is aimed to reduce the disease risk using an integrated vector management approach after increasing the surveillance capacity and outbreak response [1]. Dengue creates major socioeconomic burden and 50% population worldwide is at risk. Changing climatic, trade, socioeconomic conditions and valuation of the virus causes the extension of this viral disease [2]. India is an endemic area for dengue fever from 19th century and the existence of all the four serotypes was proved since 1960 [3]. After 1990, several outbreaks of DF/DHF were reported from Tamil Nadu state. Recently dengue has penetrated to rural areas even though it was once considered as an urban disease [4]. Dengue outbreak in India during 2012 recorded a total of 47,029 DF cases and 242 deaths. Tamil Nadu state had reported 12,264 dengue cases from various districts [5]. Geographical spread of this disease has increased the number of cases. The prevailing reporting system, diagnostic laboratories and monitoring of the vector role in the outbreak has further strengthened the surveillance network to prevent and control dengue in many places. An outbreak investigation was undertaken in the Theni district of Tamil Nadu during the month of February 2015 to understand any seasonal shift in the dengue season, to know the causative mosquito vector responsible and to identify its key breeding habitats.

2. Materials and methods
Theni district lies at the foot of the Western Ghats between 9' 39' and 10' 30' North latitude and between 77' 00' and 78' 30' of East Longitude. The Central location is situated 10°04′N 77°45′E. The district is bounded by Dindigul district to the North, Madurai district to the East, Virudhunagar district to the Southwest, and Idukki district of the Kerala State to the West. The CRME team proceeded to Theni district on 9.2.2015 and held discussions with the DDHS health officials of Theni district (DPH&PM, Tamil Nadu) to

survey the dengue outbreak areas and to undertake the entomological investigations. Theni district has blocks like Aundipatti, Periyakulam, Theni, Bodinayakanur, Chinnamanur, Cumbam, Uthamapalayam and K. Mayiladumparai. Based upon the dengue cases reported in the different blocks from 2012 to 2015 (up to January), it was decided to conduct the investigations in the places where larger incidence of dengue was reported. Entomological observation in Theni district was initiated taking cognizance of the ongoing epidemic during the month of February 2015. Entomological investigations were carried out to understand the key vector breeding sources to apply appropriate control strategy. All the emerged adult mosquitoes were examined for species identification using standard keys [6]. The various indices like House index (HI), container index (CI), Breteau index (BI) and pupal index were calculated [7].

3. Results & discussion

Some of the suspected dengue fever sera samples collected from the Aundipatti and Periyakulam GH showed dengue positives. The team after conducting preliminary investigations, visited Aundipatti block (Jakkampatti, T. Malayapuram, Pappammalpuram and Kondamanaickenpatti - T. Subbulapuram PHC) on 9.2.2015, 10.2.2015 & 26.2.2015, Periyakulam block (Periyakulam Urban area -Varathappan street Ward 10, E. Pudupatti PHC -Azhagarsamy puram & Pattalamman kovil street and Vadaputhupatti PHC - Melakamakapatti) on 11&12.2.2015, Theni block (2 Theni municipality areas - Bungalamedu -W31, 3rd St., & Pallivasal street -W7) on 16.2.2015, Bodinayakanur block (Dombucherry PHC-Uppukottai & Kodangipatti) on 17.2.2015, Chinnamanur block (Odaipatti PHC –Seepalakottai) on 20.2.2015, Cumbam block (Cumbam Municipality - Ulagathevar st., Ward 2 and KK Patty PHC -KK Patty) on 24.2.2015 to conduct dengue vector based entomological investigations.

Entomological investigations were conducted in the aforementioned places and the *Stegomyia* indices were estimated. A total of 515 houses were surveyed and 66 houses showed positive containers (HI 12.82). Out of the total 3219 containers surveyed, 89 containers were found positive with the larval breeding (CI 2.76 & BI 17.28). A total of 411 pupae were collected from this study (PI 79.81). In the Aundipatti block maximum breeding was recorded in Kondamanaickenpatti situated in the T. Subbulapuram PHC and the BI and pupal index was 45.83 &145.83 respectively. Similarly in Periyakulam block maximum breeding was recorded in Melakamakapatti situated in Vadaputhupatti PHC and the BI & PI was 39.29 &1221.43 respectively. In Bodinayakanur block, maximum breeding was recorded in Kodangipatti situated in Dombucherry PHC and the BI &PI was 28.57 & 71.43 respectively. In the Cumbam block, maximum breeding was recorded in KK Patty in the KK Patty PHC and the BI was 37.93 (Table 1). In the Theni and Periakulam urban areas the *Stegomyia* indices were very low as the source reduction activities had brought down the indices. Analysis of BI – number of positive containers per 100 houses was used to identify the high risk areas for dengue transmission [8].

Table 1: Dengue outbreak survey in Theni district-Dengue epidemiology and vector surveillance indices - February 2015

Sl. No	Date	Block	PHC	Area	Dengue cases**				Surveillance indices			
					2012	2013	2014	2015*	HI	CI	BI	PI
1	09.02.15	Aundipatti	T.Subbulapuram	Jakkampatti	23	74	17	23	14.29	3.25	17.86	0.00
2	10.02.15			T.Malayapuram					12.50	3.26	18.75	0.00
3	26.02.15			Pappammalpuram					20.83	2.86	20.83	0.00
4	26.02.15			Kondamanaickenpatti					33.33	6.67	45.83	145.83
5	11.02.15	Periyakulam	Periyakulam	Varathappan street Ward 10	0	39	21	14	4.17	0.75	4.17	0.00
6	11.02.15		E.Puddupatti	Azhagarsamypuram					10.00	3.13	17.50	0.00
7	11.02.15		E.Puddupatti	Pattalammankoil street	0	14	12	2	4.17	0.68	4.17	0.00
8	12.02.15		Vadaputhupatti	Melakamakapatti	0	23	6	2	28.57	9.40	39.29	1221.43
9	16.02.15	Theni	TheniMpty	Bungalamedu(W31)3rd St.,	0	77	19	8	0.00	0.00	0.00	0.00
10	16.02.15		TheniMpty	Pallivasal street (W 7)					3.57	0.30	3.57	0.00
11	17.02.15	Bodinayakanur	Dombucherry	Uppukottai	9	31	5	3	6.52	1.07	6.52	4.35
12	17.02.15		Dombucherry	Kodangipatti					14.29	4.55	28.57	71.43
13	20.02.15	Chinnamanur	Odaipatti	Seepalakottai	0	26	5	1	12.00	3.02	16.00	4.00
14	24.02.15	Cumbam	CumbamMpt	Ulagathevarst., Ward 2	0	74	4	2	10.71	1.58	10.71	0.00
15	24.02.15		KK Patty	KK Patty	0	32	3	2	31.03	7.33	37.93	0.00
	Total				32	390	92	57	12.82	2.76	17.28	79.81

* Till January 2015 ****Source:** DPH&PM, Tamil Nadu

Among the positive containers, cement cisterns (21.35%), plastic containers (19.1%), plastic drums (17.98%), cement tanks (16.85%) and the metal containers (12.36%) were the major key breeding containers contributing to the dengue vectors. Minor breeding grounds were the metal drums (3.3%), water sumps (3.3%), discarded containers (1.12%), grinding stone (1.12%), mud pot (1.12%), fridge tray (1.12%) and stone tank (1.12%) (Fig.1). Indoor containers outnumbered the outdoor containers in these areas. The principal dengue vector is *Aedes aegypti* only.

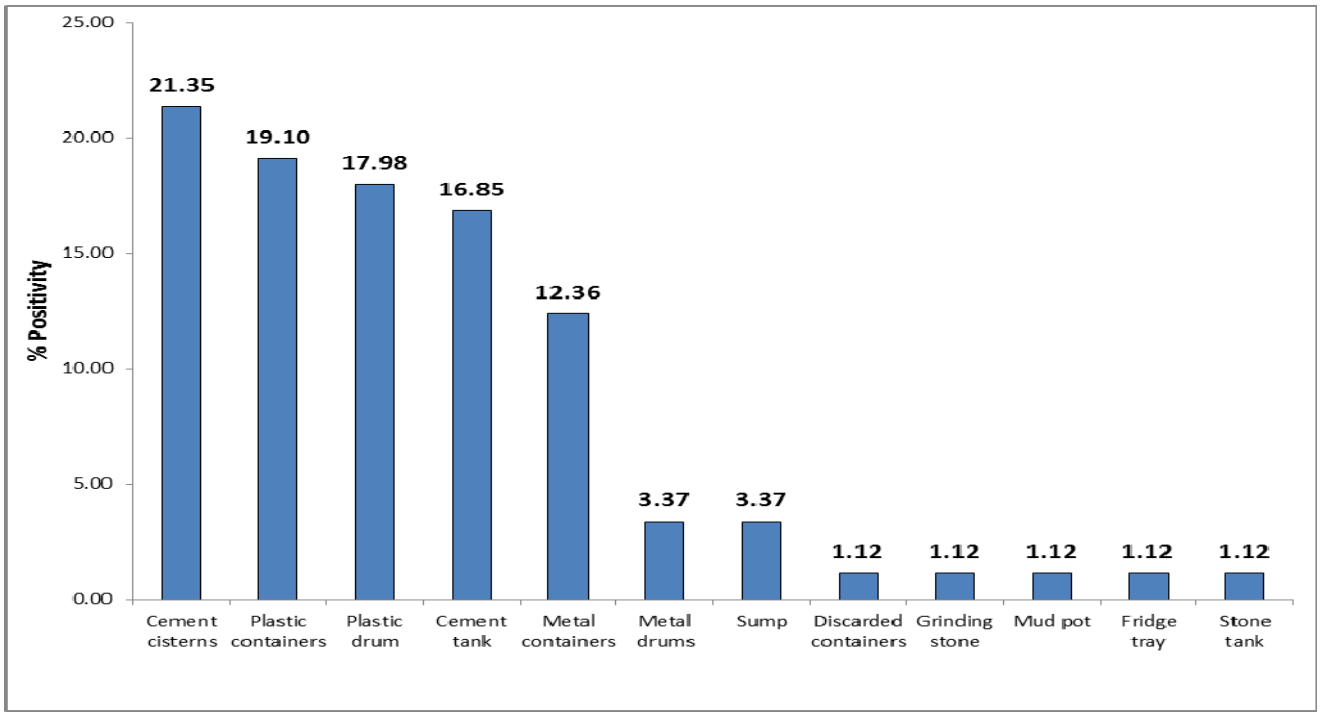

Fig 1: Surveillance indices: Percentage of containers positive during dengue outbreak survey in Theni district (Feb 2015)

Theni has ample water supply resources. Berijam lake serves as the main source of water supply for the town Periyakulam and Kottakudi river caters to the drinking water needs of Bodinayakanur. Cumbum, is supplied with water for drinking and agriculture from the Periyar river. Tiger falls is a dainty fall enroute to Munnar situated between Bodi and Bodimettu from Theni. Vaigai Dam is built across the river Vaigai near Aundipatti. Aundipatti block has water scarcity and this forces people to store water which results in breeding of vector mosquitoes. During this outbreak situation, in the water starved areas, measures were undertaken to improve the water supply to once in 2-3 days instead of once in 10-15 days to prevent storage of water which would lead to vector breeding. Theni comes under medium rainfall region. The normal rainfall of this district is 829.8 mm. South West monsoon accounts for 21%, North East monsoon for 46% winter rain for 6% and summer rain for 27% of total rainfall. Many places in Tamil Nadu are dependent on rivers for drinking water and deficit in the rainfall reduces drinking water supply. People are thereby forced to store water in open containers for many days to overcome this situation. In Tamil Nadu most of the dengue cases were reported during Northeast monsoon and hardly there were any cases in winter season [9], but this outbreak occurred only during the winter season (January-February). Moreover this outbreak was recorded both in the urban and rural environment of Theni district. Source reduction is an astounding task was carried out in the water starved Aundipatti region and rural areas compared to the urban areas. By altering the frequency of water supply and by the effective IEC campaigning as observed in Theni and Periakulam municipality areas the *Stegomya* indices were lowered effectively.

4. Conclusion

Dengue continues to spread to newer areas, newer populations and in increasing magnitude. More often people travel within the district or state or countries to secure jobs in areas at risk of dengue infection. When they get febrile infection return to their native places with the infection and thereby inadvertently introduce that infection which was free from that disease. The infected man will act as the amplifier of that viral disease and transmit the infection to the local population. Since there is no vaccine available for the control of dengue, control of larval breeding sources took priority for the control operation. *Aedes aegypti* is the predominant mosquito vector transmitting dengue virus recorded in this study. Increased urbanization and depletion of forest cover *Aedes aegypti* invaded the suburbs and other town areas displacing its other competitor species [10]. The rapid growth of industries and building activities, improvement of transport facilities such as railway and roads, increased movement of people from urban to rural areas and environmental changes have all favored the spread of dengue in rural as well as urban areas [11]. Surveillance and the IEC (Information, education and communication) must go in hand to prevent future outbreaks. Several human-induced factors such as changes in the rural ecology associated with developmental process, climatic and socioeconomic condition paved the way for the extension of this virus to several other places and changed the regular dengue season [9]. Since there is a shift in the dengue prevalence to the winter season this year 2015, establishment of routine permanent dengue surveillance system is the solution to undertake source reduction means systematically and continuously throughout the year [12, 13] both in the urban and rural agglomerations to detect and reduce the further emergence of this dreaded disease.

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