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Prevalence and risk factors of dengue vector infestation in schools at Dindigul, Tamil Nadu, India

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Abstract
Background & Objectives: Dengue is fast emerging pandemic-prone viral disease in many parts of the world. The incidence of dengue has increased 30-fold over the last 50 years and putting almost half of the world's population at risk. This study was aimed to evaluate intensity of vectors breeding and risk factors in schools at Dindigul Health Union district.
Methods: Schools in Dindigul HUD were inspected and carried out anti larval activities which were performed by Health Inspectors by identifying immature stages of *Aedes* species in common mosquito breeding habitats in school campus. The Dengue incidence data was collected from the fever surveillance agencies of Government medical colleges and private hospitals.
Results: Cement cisterns, plastic drums and tiers were the major breeding habitats and Container Index was >50% recorded in all schools at Dindigul HUD. High dengue incidence reported among school students in the blocks of Bathalagundu, Reddiarchatram and Natham during 2013 than 2012. More cases reported between the months of September and December. Minimum dengue vector infestation recorded in Dindigul municipality and maximum infestation recorded at Reddiarchatram block.
Interpretation & Conclusions: The schools are the hot spot for transmission of dengue virus in the community. Hence top priority should be given to schools during planning of Dengue control activities to curtail the dengue prevalence and risk factors among the student community.

Keywords: Container index, Entomological surveillance, Health Union District

1. Introduction
Dengue is an acute febrile illness caused by Flavi virus, and there are four distinct, but closely related, serotypes of the virus that cause dengue DEN-1, DEN-2, DEN-3 and DEN-4 [1]. The incidence of dengue has increased dramatically in recent decades. World Health Organisation currently estimates that 50–100 million dengue infections occur worldwide every year. Before 1970, only nine countries had experienced severe dengue epidemics. Today, the disease is endemic in more than 100 countries in African, Americas, Eastern Mediterranean, South-East Asia and the Western Pacific regions. The Americas, South-East Asia and Western Pacific regions are the most seriously affected where more than 1.2 million cases were reported in 2008 and over 2.3 million in 2010. In 2010, 1.6 million cases of dengue were reported in the Americas alone, of which 49000 cases were severe dengue. An outbreak of dengue on Madeira Islands of Portugal in 2012 resulted in over 2000 cases and imported cases were detected in 10 other countries in Europe apart from mainland Portugal. An estimated 500000 people with severe dengue require hospitalization each year, a large proportion of whom are children [2].
Dengue transmission is effected through female mosquitoes, i.e., *Aedes aegypti*, *Aedes albopictus* [3]. Dengue fever may transform into dengue hemorrhagic fever and dengue shock syndrome. These conditions are fatal causing haemorrhages and leakage of plasma respectively [4]. Disease surveillance, vectors surveillance and monitoring the monsoon periods are the major components in dengue surveillance. The entomological surveillance is used to determine the changes in the geographical distribution and density of vectors, evaluate the control programs and timely intervention. The entomological parameters i.e., House index, Container index, Breteau index and Pupal index are indicate the level of vectors infestation and evaluation of control strategies [5]. In this study the Container index parameter used to understand vectors infestation in schools during the dengue control activities in Dindigul HUD. In recent years, Dengue Fever/Dengue Haemorrhagic Fever (DF/DHF) continues to be a major public health problem in India. In Tami Nadu the annual dengue morbidity and mortality reported in thousands and hundreds respectively during 2012 and 2013. In Dindigul HUD about 200 dengue cases were reported in the year 2012 and 2013, mysterious fever

mortality also reported. In many schools dengue cases reported among the school children and teachers community [6]. This study may enlighten to understand the intensity of dengue vectors infestation and disease transmission in schools at Dindigul HUD.

2. Materials and Methods

2.1 Study Area

Dindigul HUD is situated southern part of Tamil Nadu near Western Ghats hills and situated 10º 21' 14.4" N, 77º 59' 6" E. It has an area of 4266.64 km^2 and seven Blocks and one Municipality. The study period was two years from 2012. The population of this district is 1183887 (598654 male and 590633 female). The Agriculture is the main profession in this district. Nearly 500 schools including government, government-Aided and private schools are running for children education in this district. The schools in blocks and Municipality were visited and carried out Anti larval works and provided health education to the children and teachers by a team comprising of Entomologist, Health Inspectors, Medical officers and Village Health Nurses during school health programme, Mobile Medical Unite visit to the village and dengue incidence investigation.

2.2 Entomological Surveillance

Immature stages of *Aedes* vector surveillance was carried out in the schools of seven blocks and municipality. The immature stages collected from different habitats in the school's campus were reared in the laboratory and the species identified as *Aedes aegypti* and *Aedes albopictus* after emergence into adults. The Anti-Larval work was performed by skilled field workers and Health Inspectors by identifying immature stages of *Aedes* species in common mosquito breeding habitats in the school campus such as cement cisterns, Over Head Tanks, tires, coconut shells and plastic drums. These sources were removed immediately and if removal is not possible those sources were treated with the larvicide Temephos to kill the immature stages.

The important entomological index i.e., Container Index (CI) was calculated from the anti-larval work for assessing the infestation impact in schools. This container index will be forecast the dengue outbreak in the particular village and helpful to the public health authorities to monitor and carryout the control measures [7, 8]. To calculate CI the following formula was used.

$$CI = \frac{\text{Number of wet containers found positive with } \textit{Aedes} \text{ larvae}}{\text{Total Number of wet containers searched}} \times 100$$

In India, all Dengue/DHF outbreaks have been associated with *Aedes aegypti* having a container index of more than 20% (9).

2.3 Dengue data surveillance

Dengue incidence data were collected from the fever surveillance agencies of Government Medical College Hospitals, Zonal Entomological Team and private hospitals. These data were found positive for dengue virus infection based on the detection of NS1 antigen and immunoglobulin M (IgM) antibodies in IgM Capture Enzyme-Linked Immunosorbent Assay (ELISA) [10, 11].

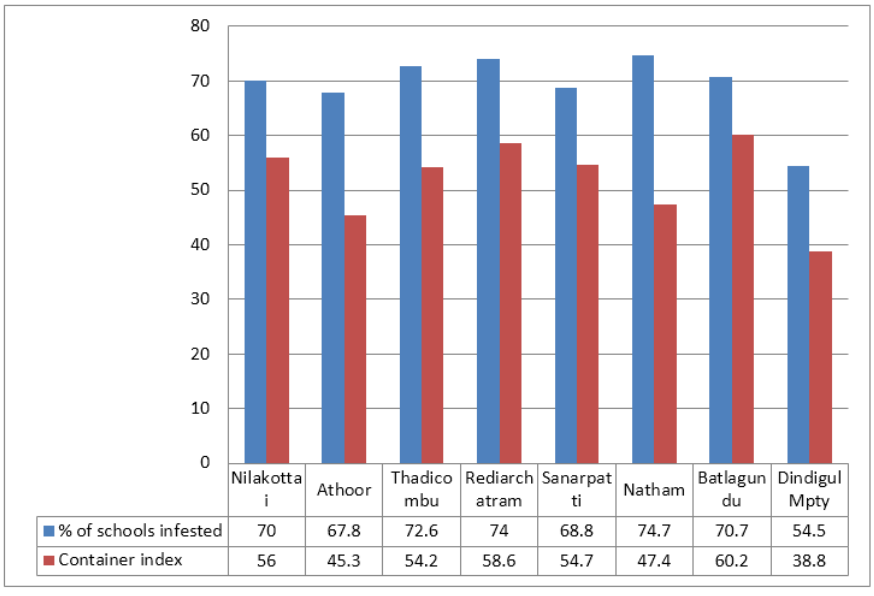
2.4 Statistical analysis

The % of infested schools and container index were analyzed by `t` test. The p= 0.001 by SPSS version 16.0 (SPSS Inc., Chicago, IL, USA). The dengue cases reported in schools and i ts respective blocks and municipality of Dindigul HUD in the year 2012 and 2013 were analyzed by `t` test. The p= 0.004.

3. Results

3.1 Entomological data

In this study, Plastic tanks, Cement cisterns, and tiers were the major breeding habitats (60% to 80%) for dengue vector breeding inside the school campus. Other breeding sources were the unused grinding stones, Pit tapes and coconut shells (20%) also recorded inside the schools. The blocks of Nilakottai, Thadicombu, Reddiarchatram, Natham and Bathalagundu reported 70%, 72.6%, 74%, 74.7% and 70.7% schools infested by dengue vector respectively in dindigul HUD. The high CI recorded in Nilakottai, Reddiarchatram, Shanarpati, Thadicombu and Bathalagundu blocks i.e., 56%, 58.6%, 54.7%, 54.2%, and 60.2% respectively and moderate CI recorded at Dindigul Municipality 38.8 % (Figure 1).

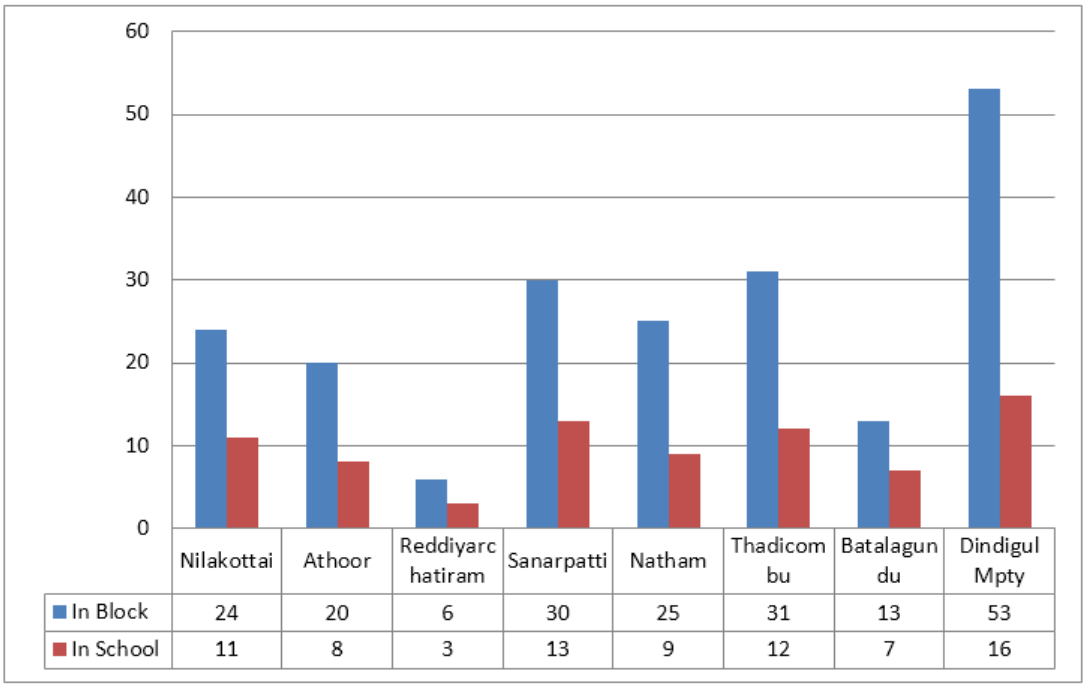


	Nilakottai	Athoor	Thadicombu	Rediarchatram	Sanarpatti	Natham	Batlagundu	Dindigul Mpty
% of schools infested	70	67.8	72.6	74	68.8	74.7	70.7	54.5
Container index	56	45.3	54.2	58.6	54.7	47.4	60.2	38.8

Fig 1: Infested schools and their container index at block level in Dindigul HUD.

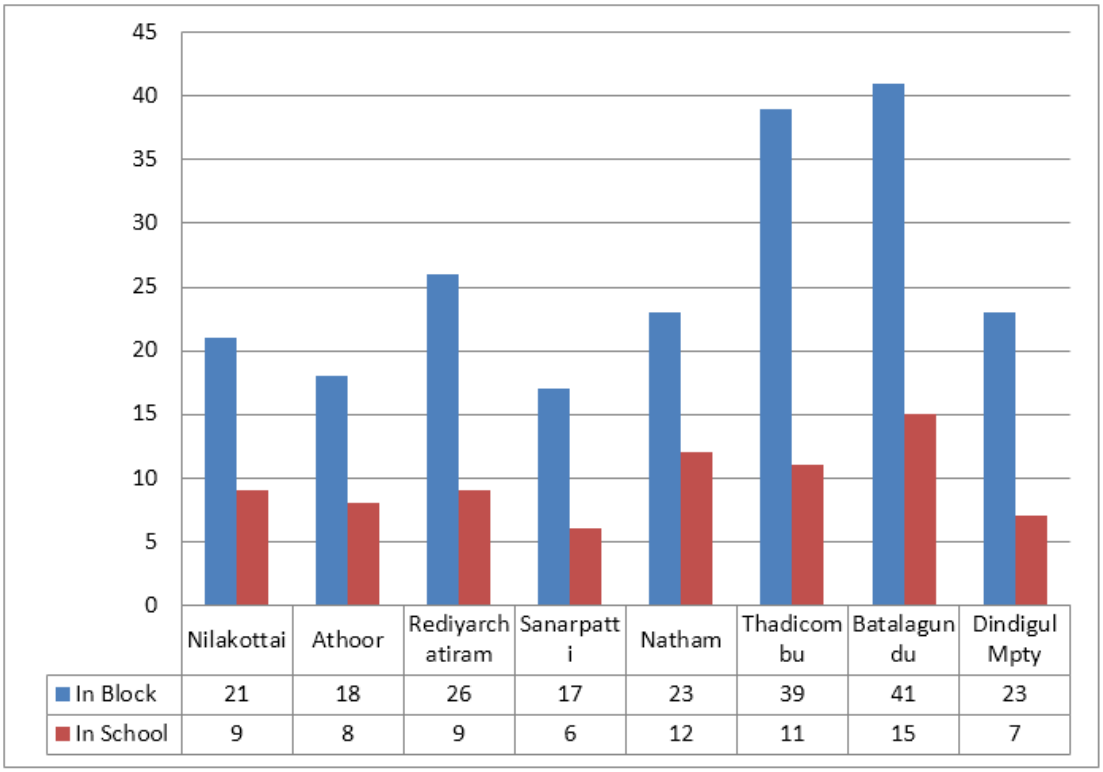
3.2 Morbidity data

During the year 2012 and 2013 dengue cases 202 and 208 were reported respectively and also 79 and 77 dengue cases were recorded at schools in Dindigul HUD (Figure 2, 3). In the year 2013, Natham, Reddiarchatram and Bathalagundu blocks were reported 12, 9, and 15 dengue cases than the year 2012. In both years dengue cases trend increased in the months between June and December (Figure 4)



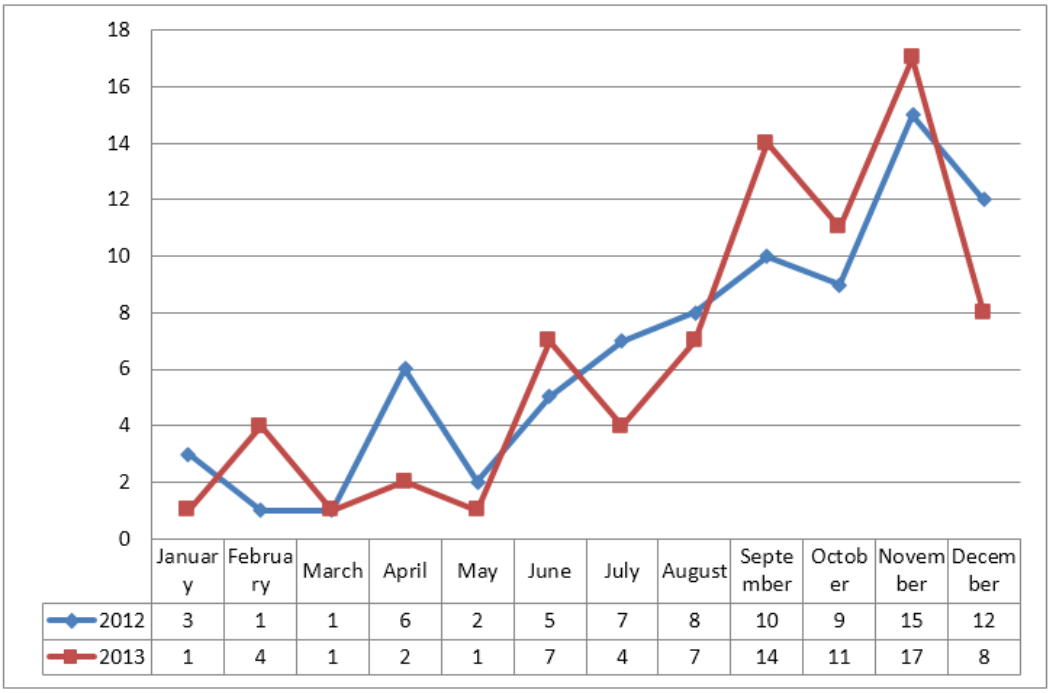
	Nilakottai	Athoor	Reddiyarchatiram	Sanarpatti	Natham	Thadicombu	Batalagundu	Dindigul Mpty
In Block	24	20	6	30	25	31	13	53
In School	11	8	3	13	9	12	7	16

Fig 2: Comparison of dengue cases reported in schools and blocks in 2012.



	Nilakottai	Athoor	Rediyarchatiram	Sanarpatti	Natham	Thadicombu	Batalagundu	Dindigul Mpty
In Block	21	18	26	17	23	39	41	23
In School	9	8	9	6	12	11	15	7

Fig 3: Comparison of dengue cases reported in schools and blocks in 2013.



	January	February	March	April	May	June	July	August	September	October	November	December
2012	3	1	1	6	2	5	7	8	10	9	15	12
2013	1	4	1	2	1	7	4	7	14	11	17	8

Fig 4: Month wise Dengue cases reported in schools at Dindigul HUD.

4. Discussion

The result and discussion were mainly based on the entomological parameters and dengue cases reported in schools in dindigul HUD. Nearly 60 to 70% schools were infested by the dengue vector. It is also surprising that the schools are transmission foci for dengue infection and chance of focal fever outbreak [12]. Almost all schools in blocks are the hot spot for dengue incidence in the Dindigul HUD, because of dengue vector infestation persistent in schools and lack of awareness of dengue control activities among the school students and teachers. So that dengue incidence reported throughout the year in schools in Dindigul HUD. The main infestation places are toilets, Noon meal centre kitchen and tyres keeping places in schools [13]. The low intensity of dengue vector infestation recorded in Dindigul Municipality because of the Dengue control awareness present among parents and teachers in Municipal area. The vector breeding sources increased during North East monsoon and South West monsoon in and around the schools. Hence the dengue incidence also increased during the months from June to December. The dengue cases reported during 2012 and 2013 are nearly same but during 2013 Bathalagundu, Natham and Reddiarchatram blocks reported dengue cases in increasing trend. In Nilakottai, Reddiarchatram and Bathalagundu Blocks schools the container index is high as well as dengue incidence also increased. Indian Council of Medical Research recorded DEN-2 serotype in Dindigul HUD. If any other serotypes will introduce in future cross reactivity may occur. We came to know that school children died due to mysterious fever in some blocks during our investigation. But there was no proper fever investigation carried out in these cases. The high Entomological index recorded in schools indicates that improvement should be needed in dengue control measures, school health programme, Mobil medical unit visit to the village and school sanitation certificate issued by the health authority.

Though dengue is a self-limiting disease, the dengue virus circulation has been established in schools and there is possibility of perennial dengue incidence in Dindigul HUD. The result of this study is schools are the hot spot in villages [14, 15]. Tamil Nadu has experience in devastating dengue infection at any time, any place, like that all favourable facts are present in most of the schools for an outbreak. To reduce the dengue related morbidity and mortality among school children and teachers, strengthening of district level epidemic coordination meeting, redesign the school health programme and Mobile Medical Unit visit in village and strictly monitor the issuing of school health certificate to the schools. And also top priority should be given to schools for AL works during pre-monsoon and post monsoon dengue control activities planning [16]. This can be achieved through an integrated approach and co-ordination of district Administration, education department, public health department and community.

5. Acknowledgements

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6. Conflicts of interest

All authors declare no conflicts of interest.

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