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Prevalence of Dengue Vector *Aedes aegypti* and its Significance in Dengue Transmission in Delhi.

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ABSTRACT

Dengue is one of the most prevalent vector borne diseases in India. Knowledge of prominent breeding sites in a locality is a prerequisite for source reduction for the control of breeding of *Aedes* mosquito. The present study was carried out to know the container material most suitable for the survival of the *Ae. aegypti* in different seasons. Three municipal zones of Delhi South, Najafgarh and Shahdara North were selected for the study based on the previous year's dengue cases. Larval indices were highest in South zone followed by Shahdara North zone and Najafgarh zone. House Index were 17.1, 5.0 and 4.7; container index were 7.0, 1.9 and 1.7; and breteau Index were 25.6, 5.6 and 5.3 in South, Shahdara North and Najafgarh zones respectively. Among all the positive containers, highest positivity of *Ae. aegypti* larvae was recorded in plastic containers in South zone (86.90%), Najafgarh zone (70.58%) and Shahdara North zone (63.15%). Earthen pots were the second most positive containers in Shahdara North zone (21.05%) and 11.76% earthen pots were positive in Najafgarh zone. The role of desert coolers for breeding of *Aedes* mosquito was found negligible. The study showed plastic containers and earthen pots were the most productive containers for *Aedes* breeding. Therefore, emphasis should be made for control of breeding in plastic and earthen containers preferably as compared to desert coolers.

Keywords: Dengue, *Aedes aegypti*, breeding containers, vector surveillance and larval indices

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INTRODUCTION

Dengue is one of the most prevalent vector borne diseases in India. During the year 2015, nearly one lakh cases of dengue were reported from the country by national vector borne disease control program [1]. The disease is caused by the four serotypes of a flavivirus DENV1, DENV2, DENV3 and DENV4 [2]. The dengue virus is transmitted to human beings by the biting of female *Aedes* mosquitoes. Two species of *Aedes* has been recognized as the vector of dengue in the country *Aedes aegypti* and *Aedes albopictus*. *Ae. aegypti* is the primary vector of dengue with its major presence in urban areas while *Ae. albopictus* is the secondary vector for dengue mainly found in rural areas. Presently there is no treatment available for the dengue either in the form of a drug or a vaccine. The only way of controlling the disease is to control the population of *Aedes* mosquito by source reduction through proper surveillance, implementation of urban bye-laws as well as Information Education and Communication activities [3-5].

Knowledge of prominent breeding sites in a locality is a prerequisite for source reduction. It is achieved by vector surveillance that is an important tool in generating entomological data for knowledge of breeding sites and their control. Comprehensive field surveys of *Ae. aegypti* breeding in Delhi have been carried out by several workers [3; 6-8)]. In a field survey undertaken to search *Aedes* breeding in eight municipal zones of Delhi, Sangam Vihar locality of South zone was found most positive for *Aedes* breeding [3]. In this field survey, bird feeding earthen pots were the second most preferred breeding habitats for *Aedes* mosquito after cemented tanks. In a similar study carried out in 2011 by Kumari et al, bird feeding pots, earthen pots and mud pots were the most preferred breeding habitats of *Aedes* mosquito [7].

Many previous researchers have reported *Ae. aegypti* to breed in intradomestic and peridomestic containers such as tank, cooler, cistern, bird pot, tyre, water storage jar, plastic cup that are made up of different materials *i.e*. plastic, iron, rubber, earthen material *etc* [4, 9]. Relationship between the container material and *Aedes* larval development has been studied and the container material was found to be affecting the larval development and survival. Recently, earthen pots were found to be the most suitable container for *Ae. aegypti* larval development [9]. In this study iron containers took more time for development of larval to pupal stage as compared to plastic and earthen containers. The present study was carried out to know the container material most suitable for the survival of the *Ae. aegypti* in different seasons.

MATERIALS AND METHODS

Delhi, the capital of India, has a population of nearly 16.3 million and is the 2nd most populous city of the country. It has an area of 1484 sq.km surrounded on three sides by Haryana and to the east, across the river Yamuna by Uttar Pradesh. Delhi is located at 28.61^0 North latitude and 77.23^0 East longitude on the intersection topography. Topographically Delhi is divided into three parts- the Yamuna flood plain, the Ridge and the plain area. The ridge constitutes the most dominating physiographic features of this territory. The average annual rainfall is 714 mm and annual temperature ranged 5^{o}C-40^{o}C respectively.

Control of vector borne diseases in Delhi is mainly done by three agencies - Municipal Corporation of Delhi (MCD), New Delhi Municipal Council (NDMC) and Delhi cantonment Board (DCB). In year 2012, MCD was trifurcated into South Delhi Municipal Corporation (SDMC), North Delhi Municipal Corporation (NDMC), and East Delhi Municipal Corporation (EDMC). The three MCD are administratively divided into 12 zones. Three zones of Delhi South, Najafgarh and Shahdara North were selected for the study based on the previous year's dengue cases. A door-to-door entomological survey was conducted in houses of all study sites from July, 2015 through May, 2016. Monthly field visits were undertaken in each zone for checking the presence of *Aedes* breeding. Only wet containers were searched within houses and its periphery including rooftops. All kinds of breeding habitats in the study area like overhead tanks, cemented tubs/tanks, iron/metal containers, junk materials, desert coolers, discarded tyres, earthen pots etc. were screened for the presence of immature stages of *Aedes* mosquitoes. Large containers were searched with the help of dipper of 300 ml capacity (having white background for better visibility) while small containers were searched using plastic bowls (500 ml) and pipette. Flash light was used for detecting the *Aedes* breeding. The data on larval survey were analyzed and calculated in terms of different indices like container index (CI), house index (HI), breteau index (BI) as per the procedure of WHO [10]. Breeding preference ratio of *Aedes aegypti* for different containers was calculated as per the published method [4].

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Epidemiological data for dengue in Delhi from year 2012-2015 was obtained from the office of the MCD. The data was analyzed using SPSS 16.0 statistical software to correlate dengue cases in year 2015 with the breeding indices of *Aedes* in the selected zones.

RESULTS

The distribution of *Aedes* larvae and breeding preference ratio (BPR) among all container habitats is given in table-1. Among all the positive containers, highest positivity of *Ae. aegypti* larvae was recorded in plastic containers in South zone (86.90%), Najafgarh zone (70.58%) and Shahdara North zone (63.15%). Earthen pots were the second most positive containers in Shahdara North zone (21.05%) and 11.76% earthen pots were positive in Najafgarh zone. Cemented containers were the least positive containers in all the studied zones with positivity ranging from 0 - 3.5%. Out of the four container materials, earthen pots were the most preferred breeding habitats (3.33) in Shahdara North zone and second most preferred breeding habitats in Najafgarh zone (1.43). There was a variation in breeding preference ratio of different containers among three zones as shown in table 1.

Table-1: Breeding Preference Ratio (BPR) of *Aedes* in different container materials

Zone	No. of wet containers					Breeding preference ratio
	Container material	Container examined	X%	Positive with Aedes	Y%	Y/X
South zone	Plastic	1059	87.88	73	86.90	0.98
	Earthen pot	17	1.41	0	0	0
	Iron	78	6.47	5	5.95	0.91
	Cement	30	2.49	3	3.57	1.43
	Other	21	1.74	3	3.57	2.04
	Total	1205		84		
Najafgarh zone	Plastic	706	71.45	12	70.58	0.98
	Earthen pot	81	8.19	2	11.76	1.43
	Iron	102	10.32	3	17.64	1.70
	Cement	79	7.99	0	0	0
	Other	20	2.02	0	0	0
	Total	988		17		
Shahdara North zone	Plastic	664	66.59	12	63.15	0.94
	Earthen pot	152	6.31	4	21.05	3.33
	Iron	103	15.24	2	10.52	0.69
	Cement	103	10.33	0	0	0
	Other	15	1.50	1	5.26	3.49
	Total	997		19		

Larval indices were highest in South zone followed by Shahdara North zone and Najafgarh. HI were 17.1, 5.0 and 4.7; CI were 7.0, 1.9 and 1.7; and BI were 25.6, 5.6 and 5.3 in south, Shahdara North and Najafgarh zones respectively. Generally larval indices were higher during July-September months thereafter these were go down during November-January months and again rose during February – April months (Figure 1). Plastic containers were found positive for *Aedes* larvae throughout the study period. Earthen pots, iron and cement containers were found positive only during the monsoon months. Positivity of containers was higher in July- September months than post monsoon and summer months.

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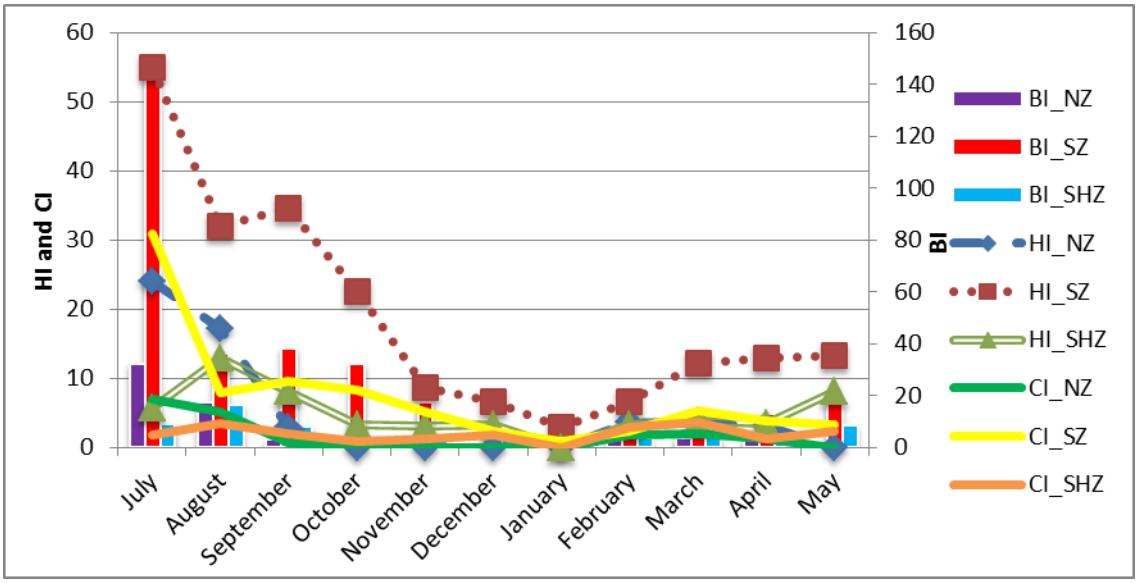

Figure 1: Monthwise breeding indices (HI, CI and BI) of *Aedes aegypti* in three different zones of Delhi

When the cases of dengue were correlated with the larval indices in each month, there was a non significant correlation observed (table 2). Number of dengue cases was lower in South zone as compared to Shahdara North and Najafgarh zones and the difference of dengue cases in three zones was more during year 2013 (table 3).

Table 2: Correlation of dengue cases with *Aedes aegypti* larval indices in three zones of Delhi using Pearson correlation

Variable	South zone	Shahdara North zone	Najafgarh zone
	Correlation coefficient (p value)		
HI	0.313 (0.378)	0.128 (0.724)	-0.208 (0.539)
CI	0.074 (0.840)	-0.256 (0.475)	-0.277 (0.409)
BI	0.048 (0.895)	0.037 (0.919)	-0.210 (0.536)

Table 3: Dengue cases in three selected zones of Delhi from 2012-14

Year	Number of dengue cases in different zones of Delhi		
	South zone	Shahdara North zone	Najafgarh zone
2012	253	257	234
2013	343	832	475
2014	82	88	107

DISCUSSION

Plastic containers followed by earthen pots/mud pots were found to be most suitable for the breeding of *Ae. aegypti*. Iron containers, cemented containers, rubber tyres and glass containers were also found positive for the *Aedes* breeding but few in numbers. These results are in confirmation with the earlier studies where plastic containers and earthen/mud pots were the prominent habitats for *Aedes* breeding [7-8, 11-13]. Desert coolers were found positive for *Aedes* breeding only at certain instances. It shows that breeding ecology of *Aedes* has changed as during last decade, desert coolers were the main breeding source for *Aedes* mosquito [14]. But due to awareness of dengue among community and vector control programme being oriented mainly towards desert coolers, larval habitats of *Aedes* have changed towards plastic and earthen containers.

In the present study breeding of *Aedes* was found most prevalent in South zone followed by Nazafgarh and Shahdara North zone. The results are in corroboration with the earlier study where highest larval indices in the Sangam Vihar area of South zone were reported out of eight municipal zones of Delhi. The larval indices increased from July onwards and after October month there was a decrease in the indices that is

in consistency with previous studies undertaken in Delhi [8, 12, 14-16]. Larval indices recorded in present study are lower than the previous reports [3, 6, 15] but these are more than the recent study undertaken in Delhi [8]. These variations in the larval indices may be due to variations in environmental factors like temperature, rainfall and relative humidity [17].

The breeding of *Aedes* was found throughout the year in South zone but in Najafgarh zone no breeding was recorded during October to January. This may be due to the Information Education and communication (IEC) activity undertaken in Najafgarh zone. With the start of the study i.e. in July month, we educated peoples of Najafgarh zone area about different aspects of dengue, its cause, breeding habitats of *Aedes* and their control. No IEC activity was done in Sangam Vihar area. It shows the importance of IEC activity in the control of *Aedes* breeding. Earlier researchers have also shown the role of IEC activity in the control of dengue [18-20].

When the cases of dengue were correlated with the larval indices in each month, there was a non significant correlation observed. It shows that the higher breeding does not always result in more number of dengue cases and vice versa. The reason for this observation may be the site of infection with dengue virus. Generally peoples are infected with dengue virus by *Aedes aegypti* more at the site of conglomeration. Earlier researchers have not found statistically significant relationship between entomological indices and dengue cases [21-22]. A detailed analysis of the infections in children and ladies may put more light on site of infection as they are more prone to dengue infections at home.

CONCLUSION

The study showed plastic containers and earthen pots were the most productive containers for *Aedes* breeding. The role of desert coolers for breeding of *Aedes* mosquito was found negligible. Therefore, emphasis should be made for control of breeding in plastic and earthen containers preferably as compared to desert coolers.

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