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Research Article

Entomological Surveillance of Dengue Vector *Aedes* Mosquito Larvae in City Sadar Paharganj (SP) Zone of MCD, Delhi

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A B S T R A C T

Introduction: Dengue fever is an arboviral disease and its vectors are *Aedes aegypti* and *Aedes* albopictus. It is considered to be the leading cause of arboviral diseases across the world. The patterns of different urbanizations, with the growth of human population density, lead to favourable conditions for the breeding of *Aedes* species. It leads to the emergence and spreading of diseases like dengue, chikungunya, yellow fever, etc. As there is no vaccine or licensed drug available for the treatment of dengue, it is a major public health concern. One of the possible ways by which dengue transmission can be prevented is control at the level of vector and this can be achieved by entomological surveillance.

Method: In the present study, the entomological surveillance of *Ae. aegypti* in the City Sadar Paharganj (SP) Zone of the Municipal Corporation of Delhi from July 2023 to June 2024 was done.

Results: In the study, all larval indices (HI, CI and BI) were high from the month of July to August. The maximum larval breeding was found in plastic containers (39.26%) followed by earthen pots (20.09%) and coolers (17.80%).

Conclusion: As container positivity was high in plastic containers, earthen pots and coolers, therefore these can be used as vector control tools so that transmission of vector-borne diseases can be checked and timely preventive measure can be taken to suppress the seasonal infection.

Keywords: *Aedes aegypti*, Dengue, Chikungunya, Vector, Surveillance

Introduction

In India, Dengue fever has affected more than one lakh people annually in the last few years. It results in an increase in the rate of morbidity and mortality.[1] In the past decades, it has become the issue of major public health concern. Various etiological agents like chikungunya virus (CHIKV), Yellow fever virus (YFV), Zika virus (ZIKV) and dengue virus (DENV), are carried and transmitted by Aedes species in tropical and sub-tropical regions.[2-4] Dengue virus (DENV) is responsible for affecting around 390 million people annually across the world. DENV is the only one which is known to cause more infection and even death as compared to any other arthropod-borne viruses.[5] The distribution of *Aedes* mosquitoes, specifically *Aedes aegypti* and *Aedes albopictus*, in Delhi, India, is influenced by various factors including climate, urbanization, and water storage practices. *Aedes aegypti* and *Aedes albopictus* mosquitoes transmit mosquito-borne viral diseases like dengue, DHF, chikungunya, yellow fever and Zika in tropical and subtropical regions. Aedes mosquitoes breed in domestic and peri-domestic environments. Humidity and temperature are among those environmental factors that enhance the breeding sites and promote the distribution of a variety of mosquito species. Water storage containers, especially plastic containers, coolers, earthen pots, flower pots, tyres, bird pots, plastic sheets, iron pots, overhead tanks, cemented tanks and thermocol disposables serve as the main larval breeding habitats of *Aedes aegypti* mosquitoes, whereas several types of containers, such as broken cans, plastic containers, vases, flower pots, and retired tyres in urban areas[11] as well as rubber plantations and agricultural fields are known to be the most favourable breeding place for *Aedes albopictus* during the rainy season.[12] Dengue outbreaks are occurring due to the increasing frequency and intensity of vector species in India. There are more than 100 countries in the world where patients infected with dengue can be observed including Europe and the United States (USA).[13]

Climatic changes like changes in the relative humidity and temperature can affect the breeding of vectors and it may develop higher competence for disease transmission and cause a high disease burden and ultimately lead to a high economic burden in the country. It necessitates the need for entomological surveillance so that vector abundance can be predicted and the vector eradication process can be initiated timely in order to prevent dengue infection in a given geographical area.

Materials and Method

The Municipal Corporation of Delhi is one of the largest municipal bodies in Delhi state that has 12 zones having 250 wards, which cover about 1397.3 sq. km. area. There are 12 municipal wards of City SP Zone namely Shastri Nagar, Kishanganj, Sadar Bazar, Civil Lines, Chandni Chowk, Jama Masjid, Chandni Mahal, Delhi Gate, Bazar Sita Ram, Ballimaran, Ramnagar, Quresh Nagar. From these 12 wards, 08 localities were selected every month for checking Aedes larval breeding for this study. Unplanned urbanization, global warming and migration of populations are responsible for the transmission of vector-borne disease. An entomological survey for *Aedes* larval breeding sites was carried out in randomly selected localities of the City Sadar Paharganj (SP) zone of the Municipal Corporation of Delhi. No permission was required for this study. It was done in public interest. To know the larval habitat potential of the *Aedes* mosquito, this study was undertaken in the City SP zone, India from July 2023 to June 2024. All kinds of breeding habitats in the study areas like coolers, overhead tanks (OHT), plastic containers, earthen pots, flowerpots, cemented houdi, iron containers, and other wet containers were checked for *Aedes* larval breeding. In the larval survey, different entomological indices like House Index (HI%), Container Index (CI%) and Breteau Index (BI) were recorded to estimate the *Aedes aegypti* larval density. All entomological indices were calculated by using published formulae.[14]

Study Design: This is a descriptive study based on the analysis of entomological data generated during vector surveillance of the City SP Zone.

Study Period: The study period is from July 2023 to June 2024.

Data Analysis

All the mosquito larval indices were calculated manually and graphs were plotted in Microsoft Excel.

Results

In the randomly selected eight localities of City SP Zone, a total of 5040 houses were searched during the period July 2023 to June 2024 out of which 165 houses were found positive for *Aedes* larval breeding. During the survey, 218 containers were found positive out of 7003 containers searched. Slum areas were found to be highly positive for invasive *Aedes* mosquito larvae. Minimum HI and BI were noted as 0.5 and 0.7, respectively in the month of January and a minimum CI of 0.6 was found in the month of December. While maximum House Index, Container Index and Breteau Index were found in the month of August as 7.8%, 7.1% and 12.2, respectively. Breteau Index, Container Index and month-wise House Index are depicted in Fig.1. Abiotic parameters like average temperature (°C), average rain (cm) and average humidity (%) are also depicted in Fig.1.

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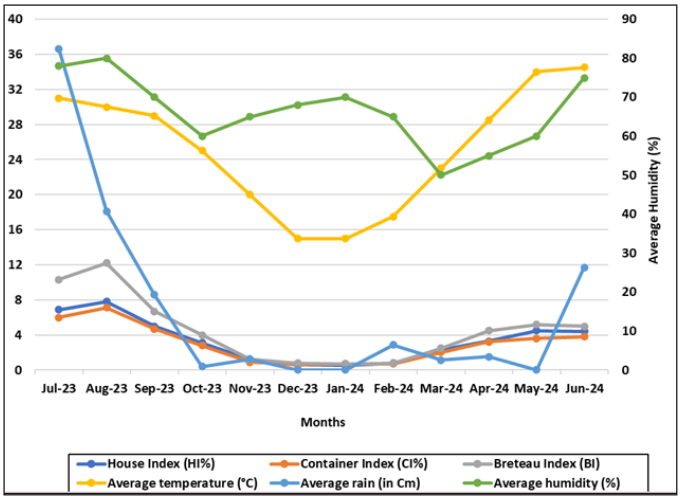

Figure 1.Month-Wise Entomological Indices of City Sadar Paharganj Zone of Municipal Corporation of Delhi, from July 2023 to June 2024 with Abiotic Parameters (Average Temperature (°C), Average Rain (cm) and Average Humidity (%)

Note: Data for abiotic parameters were taken from the website of Indian Meteorological Data Archive

Breeding potential containers were searched as over-head tanks (Syntax), under-round tanks, plastic water storage containers, desert coolers, bird pots, refrigerator trays, flower pots, tyres, earthen pots, planters, cemented houdi, disposables (PVC & tin), solid waste, discarded containers for *Aedes* mosquito larvae. Maximum positivity as well as potential areas were in slum localities. The maximum larval breeding was found in plastic containers (39.26%), followed by earthen pots (20.09%) and coolers (17.8%) (Table 1).

Table 1. Container-Wise Larval Habitat Potential for Invasive *Aedes* mosquitoes in the City SP Zone from July 2023 to June 2024

Type of Container	No of Positive Containers (%)
Plastic container	86 (39.26)
Earthen pot	44 (20.09)
Flowerpot	23 (10.50)
Cooler	39 (17.80)
Iron container	12 (5.47)
Tyre	4 (1.82)
Cemented houdi	2 (0.91)
Overhead tank (OHT)	1 (0.45)
Others	8 (3.65)

Discussion

The results of larval indices reveal that House Index (HI) was very low during the winter season i.e. November-February (0.6% and 0.8%) and maximum in August (7.8%), Container Index (CI) was very low in December (0.6%) and maximum in August (7.1%) and Breteau Index (BI) was also very low in January (0.7%) and maximum in August (12.2%). The rainfall data found a peak in the months of June-July 2023, minimum in December 2023 to February 2024[15] and temperature was found minimum during December to February, moderate in March, April, October and November and maximum in May to September, 2023[16]. The rainfall and temperature conditions support the breeding trend of the *Aedes* mosquito species. In the study, all larval indices (HI, CI and BI) were high from the month of July to August. This finding is somewhat similar to a finding from Delhi where all larval indices were also found high in August month.[17]

Preferable breeding habitats were plastic storage containers, coolers, earthen pots, flower pots, tyres, OHT, iron containers, and cemented houdi are also other preferable wet containers for *Aedes* larvae breeding sources. The maximum larval breeding was found in plastic containers (39.26%) followed by earthen pots (20.09%) and coolers (17.80%). This finding is in continuation with other finding where maximum larval breeding was found in plastic containers and coolers.[18] These water storage containers are important risk factors for the community. The residents are in the practice of storing water in different containers because of irregular and inadequate water supply, which causes high vector breeding.

Conclusion

The study reflected that the larval indices HI, CI and BI were high in the month of August and minimum in the months of December/ January 2024. Among wet containers plastic containers are the most preferable sources for *Aedes* mosquito breeding. Therefore, emphasis should be on regular water supply and the storage containers should be covered properly. This will prevent the breeding of *Aedes* mosquitoes. Vector control activities along with BCC activities should be increased especially in areas where there is a shortage of water supply and more water

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storage activity. As container positivity was high in plastic containers, earthen pots and coolers, therefore these can be used as vector control tools so that transmission of vector-borne diseases can be checked and timely preventive measures can be taken to suppress the seasonal infection.

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