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Research Article

Larval Surveillance of *Aedes* Mosquito for Assessing Dengue Prevalence in South Zone, Delhi, India

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ABSTRACT

Introduction: Dengue is a rapidly spreading mosquito-borne viral disease, now affecting over half the world's population, with South-East Asia bearing the highest burden. Transmitted mainly by *Aedes aegypti*, outbreaks peak after the monsoon due to abundant breeding sites in urban areas.

Method: In the present study, five wards from South Zone, Delhi, were selected, covering eight diverse localities, including government institutions, high-income residential areas, urban villages, and slum settlements. A door-to-door entomological survey was conducted from January to December 2024, inspecting 60 houses per locality each month. *Aedes* larvae were identified in water-holding containers such as plastic containers, flower pots, coolers, metal containers, and others, with breeding sites recorded and larval indices (HI, CI, BI) calculated.

Results: Monthly entomological surveillance in eight South Zone localities of Delhi (2024) covered 4,320 households and 7,289 containers, with 262 houses and 418 containers positive for *Aedes* breeding. The overall indices were HI: 6.1%, CI: 5.7%, and BI: 9.7 % Seasonal trends showed the lowest values in December (HI: 0.8%, CI: 0.6%, BI: 0.8) and the highest in August (HI: 19.2%, CI: 16.9%, BI: 32.5). Indices rose gradually from March, peaked in July–August during monsoon, and declined by December, reflecting strong climatic influence on vector proliferation.

Conclusion: Larval surveillance in South Zone, Delhi, showed strong seasonality of *Aedes aegypti* breeding, peaking in July–August with the highest HI, CI, and BI, indicating maximum dengue risk. Most breeding occurred in domestic containers, especially coolers, plastic containers, and water tanks. Findings stress integrated vector management (IVM) through continuous surveillance, source reduction, safe water storage, and community awareness.

Keywords: *Aedes aegypti*, Dengue, Indices, House Index, Container Index, Breteau Index

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Introduction

Dengue is a mosquito-borne viral illness that has spread rapidly across tropical regions over the past six decades, now placing more than half of the world's population at risk.[1] Its reach is expected to grow further with global issues such as climate change and rapid urbanisation.[2] According to the World Health Organization (WHO), more than 100 million dengue infections occur every year, though recent studies estimate the number may actually range between 300 and 400 million.[3,4] The disease has been confirmed in 128 countries, bringing major health, social, and economic impacts, with Southeast Asia carrying almost half of the global burden.[5] Dengue is mainly spread by *Aedes* mosquitoes, especially *Aedes aegypti*, a species that thrives in crowded urban areas where poor sanitation, stored water, and discarded containers provide ideal breeding sites.[6] These mosquitoes are also responsible for transmitting other viruses like chikungunya and Zika.

Outbreaks of dengue fever and dengue haemorrhagic fever (DF/DHF) most often occur after the monsoon season, when mosquito breeding peaks.[7] Therefore, a comprehensive control strategy is vital, which includes continuous vector surveillance and integrated mosquito management.[8] Breaking the human–mosquito–human transmission cycle by reducing *Aedes* populations is key to lowering dengue cases.[9] The WHO recommends routine vector surveillance in endemic countries to track changes in mosquito populations, predict outbreaks, and evaluate control efforts. Larval surveys are among the most widely used methods for this purpose.[10]

Such surveys, especially during pre- and post-monsoon periods, are essential in high-risk urban areas where dense populations, poor sanitation, and water-filled items like coolers, flower vases, tyres, construction sites, tanks, and discarded containers encourage mosquito breeding.[11] In larval surveys, each household is inspected for water-holding containers, and indices are calculated: the House Index (HI), Container Index (CI), and Breteau Index (BI). An HI above 1, a CI above 1, and a BI above 5 indicate a significant risk of disease transmission.[12]

Against this background, the present study was carried out in a rural and an urban locality of the South Zone, Delhi, of *Aedes* mosquitoes. The aim was not only to assess the risk of dengue transmission but also to provide health education to the community on source reduction and preventive practices.

Material & Methods

Study Area

The Municipal Corporation of Delhi (MCD) is among the largest civic bodies globally, providing services to over 11 million residents of the capital city. Administratively, the MCD is divided into 12 zones comprising 250 wards. The South Zone consists of 23 wards, with an estimated population of about 2.73 million and a population density exceeding 11,000 persons per square kilometre. This high density, combined with diverse socio-economic conditions, makes the area particularly vulnerable to vector-borne diseases.

For the present study, five wards were selected from the South Zone: Ward No. 148 (Hauz Khas), 151 (Munirka), 156 (Vasant Kunj), 160 (Saidulajab), and 172 (Chirag Delhi). Within these wards, eight localities were chosen based on two key criteria: reported dengue cases in previous years and socio-economic diversity. The selected sites included two government institutions (Indira Gandhi National Open University, Maidan Garhi, and Indian Institute of Technology, Hauz Khas), two high-income residential areas (Asian Games Village, Khel Gaon, and Vasant Kunj), two urban villages (Munirka and Saidulajab), and two slum settlements (Bengali Camp, Masoodpur, and Parvatiya Camp, Sector-4, R.K. Puram) [Fig. 1]. Mapping of these study sites was carried out using QGIS and DIVA-GIS to ensure accuracy in geographical representation.

Entomological Survey

A door-to-door entomological survey was conducted in eight localities of the South Zone, Delhi, with informed consent obtained from household owners. For this study, each household, along with its surrounding premises, was considered as a sampling unit. In every locality, 60 houses were inspected each month over a 12-month period, from January to December 2024. Systematic inspections were carried out to identify the presence of *Aedes* mosquito larvae in water-holding containers. Immature stages of were collected from a variety of domestic and peridomestic habitats, such as plastic containers, earthen pots, flower pots, coolers, metal containers, discarded tyres, cement cisterns, water tanks and others. [Fig. 2]. A torchlight was used to examine the rims of containers, and larvae were identified by the characteristic oscillatory movement of *Aedes* species. All breeding sites were recorded in detail,

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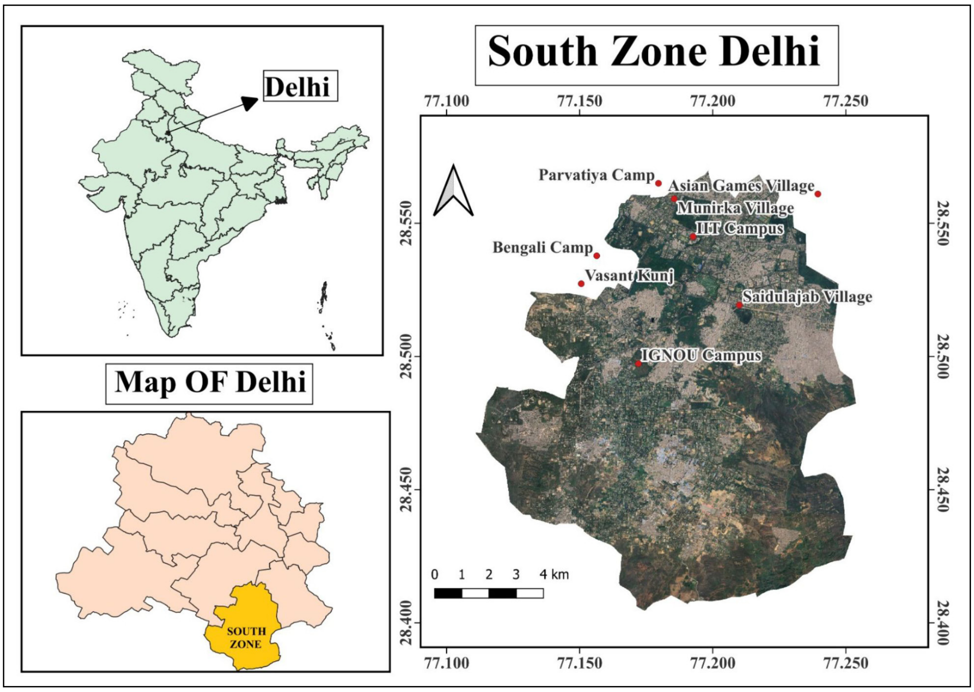

Figure 1.Map showing the study sites in eight selected localities of South Zone, Delhi

Figure 2.*Aedes* mosquito breeding habitats identified during entomological surveillance within the study area of South Zone, Delhi, India: (1) Plastic container, (2) Earthen pot, (3) Flower pot, (4) Cooler, (5) Metal container, (6) Tyre, (7) Cement cisterns, (8) Water tank, and (9) Others.

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and three standard risk indices were calculated.[13]

- **House Index (HI):** Percentage of houses found positive for *Aedes* larvae and pupae (number of houses positive for *Aedes* larvae ÷ total number of houses inspected × 100).
- **Container Index (CI):** Percentage of wet containers with *Aedes* larvae and pupae (number of containers positive for *Aedes* larvae ÷ total number of containers inspected × 100).
- **Breteau Index (BI):** Number of positive containers per 100 houses inspected (Number of containers positive for *Aedes* larvae ÷ Total number of houses inspected × 100).

Following the survey, health education was provided to all participating households. Residents were informed about common breeding sources of *Aedes aegypti*, methods for their elimination, personal protective measures, and disease prevention strategies. Visual aids such as posters and pictures were used to make the message clear.

Result

In the present study, monthly entomological surveillance was carried out across eight selected localities of the South Zone, Delhi. During 2024, a total of 4,320 households were inspected, of which 262 were found positive for *Aedes* breeding. Similarly, out of 7,289 water-holding containers examined, 418 were positive for *Aedes* larvae or pupae. The overall House Index (HI), Container Index (CI), and Breteau Index (BI) were calculated as 6.1%, 5.7%, and 9.7%, respectively. Seasonal variations were evident, with the lowest indices recorded in December (HI: 0.8%, CI: 0.6%, BI: 0.8) and the highest observed in August (HI: 19.2%, CI: 16.9%, BI: 32.5). A gradual rise in larval indices was evident from March onwards, with a sharp escalation during the monsoon season in July and August, followed by a decline from October to December. These findings highlight the strong influence of climatic conditions, particularly the monsoon and post-monsoon periods, on vector proliferation. The detailed month-wise distribution of indices is presented [Table 1] along with [Figure 3].

Tables 2 and 3, along with Figure 4, present the month-wise variation and container-specific distribution of *Aedes* larval habitats. These findings illustrate how breeding potential fluctuates across different seasons and highlight the contribution of specific container types to vector proliferation. The container-wise analysis of positive breeding sites revealed that *Aedes* larvae were predominantly associated with man-made water-holding structures. Among the 418 positive containers examined, coolers accounted for the highest proportion at 29.4%, followed by plastic containers at 25.5% and earthen pots at 14.3%. Water tanks contributed 12.4% of the breeding, while metal containers made up 7.8%. In contrast, tyres (1.6%) and cement cisterns (1.4%) showed the least contribution to larval habitats. Other miscellaneous containers, including discarded vessels and small household items, together accounted for 4%. The data demonstrate that a majority of the larval breeding was linked to domestic water storage practices, with coolers and plastic containers emerging as the most productive habitats. This container preference

Table 1.Month-wise Entomological Indices of eight selected localities of South Zone, Delhi, from January – December 2024

Months	Plastic Container	Earthen Pot	Flower Pot	Cooler	Metal Container	Tyre	Cement Cisterns	Water Tank	Others
January	3	0	0	0	0	0	0	1	0
February	5	1	1	0	2	1	0	1	0
March	4	3	2	0	3	1	1	0	1
April	2	0	0	12	2	1	1	2	0
May	3	3	1	11	1	0	1	2	1
June	6	1	0	15	0	0	2	2	3
July	21	14	1	28	6	0	0	12	6
August	26	18	6	37	10	1	0	15	4
September	17	10	0	14	5	2	0	9	1
October	10	5	2	5	2	0	1	3	0
November	9	5	0	1	2	1	0	3	1
December	1	0	0	0	0	0	0	2	0
Total	107	60	13	123	33	7	6	52	17

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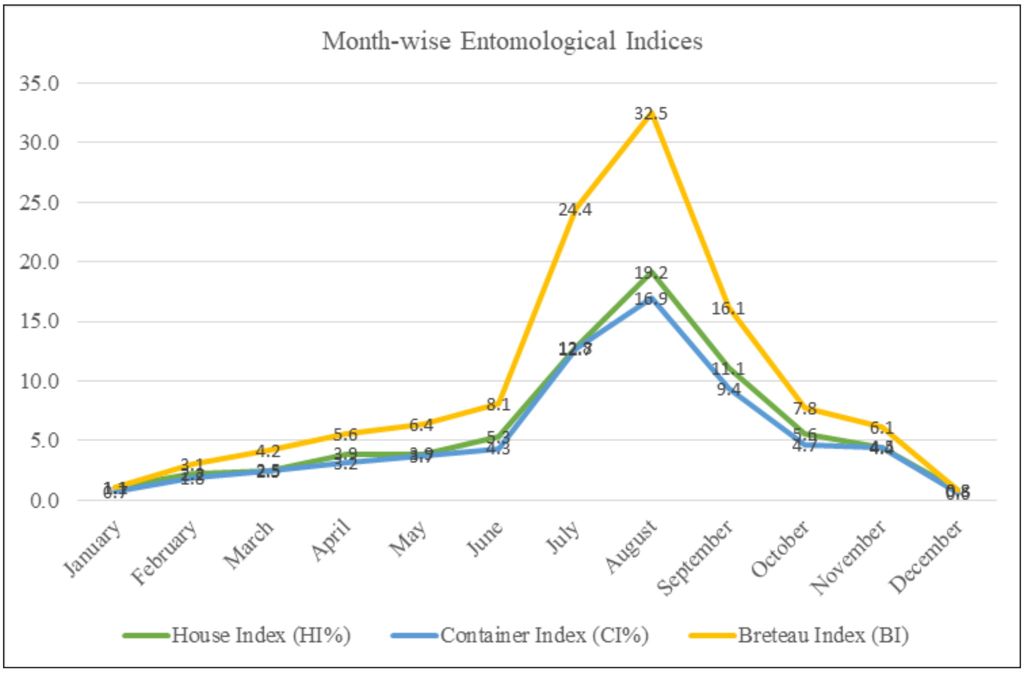

Figure 3.Month-wise Entomological Indices of South Zone, Delhi

Table 2.Month-wise Larval Habitat Potential of *Aedes* Mosquitoes from January-December 2024 in South Zone, Delhi

Months	Total House Checked	Total House Positive	Total Container Checked	Total Container Positive	House Index (HI%)	Container Index (CI%)	Breteau Index (BI)
January	360	4	570	4	1.1	0.7	1.1
February	360	8	595	11	2.2	1.8	3.1
March	360	9	607	15	2.5	2.5	4.2
April	360	14	631	20	3.9	3.2	5.6
May	360	14	621	23	3.9	3.7	6.4
June	360	19	668	29	5.3	4.3	8.1
July	360	46	693	88	12.8	12.7	24.4
August	360	69	691	117	19.2	16.9	32.5
September	360	40	617	58	11.1	9.4	16.1
October	360	20	602	28	5.6	4.7	7.8
November	360	16	494	22	4.4	4.5	6.1
December	360	3	500	3	0.8	0.6	0.8
Total	4320	262	7289	418	6.1	5.7	9.7

Table 3.Container-wise Larval Habitat Potential of *Aedes* Mosquitoes from January-December 2024 in South Zone, Delhi

Type of Containers	Plastic Container	Earthen Pot	Flower Pot	Cooler	Metal Container	Tyre	Cement Cisterns	Water Tank	Others
No of positive Containers	107	60	13	123	33	7	6	52	17
	25.5%	14.3%	3.1%	29.4%	7.8%	1.6%	1.4%	12.4%	4%

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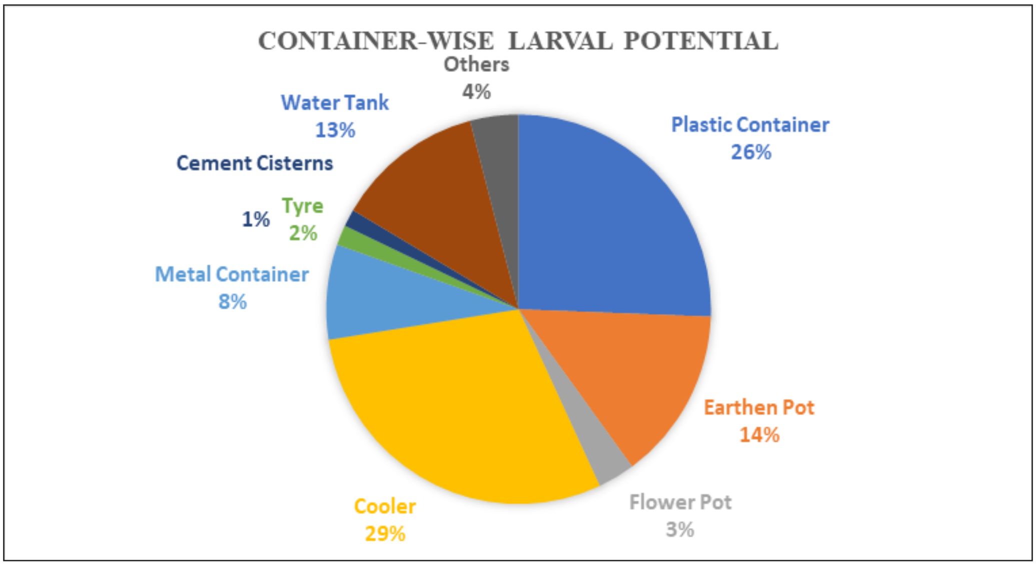

Figure 4.Container-wise breeding habitats of *Aedes* mosquitoes in South Zone Delhi

was consistent across the surveillance months, with higher positivity recorded during the monsoon.

Discussion

The monthly entomological data highlights the influence of climatic conditions on *Aedes aegypti* breeding dynamics. The indices peaked during the monsoon season, particularly in July and August, when abundant rainfall and water storage practices provided ideal conditions for mosquito proliferation. The Breteau Index values in these months far exceeded the WHO risk threshold of 5, reflecting a significant epidemic potential. This pattern aligns with earlier findings in Delhi, where larval densities were consistently higher during monsoon and post-monsoon periods due to increased water stagnation in domestic and peridomestic habitats.

The relatively low indices in the winter months of December and January suggest that colder temperatures restrict vector breeding activity. Notably, the sustained indices during the pre-monsoon period (April–June) indicate that artificial water storage also plays a role in supporting vector populations even before rainfall peaks. The results stress the urgent need for targeted control measures before and during the monsoon to interrupt the dengue transmission cycle. The variation across months also signifies that community awareness and municipal interventions should be seasonally timed to achieve maximum effectiveness.

The container-specific findings provide valuable insights into the breeding ecology of *Aedes aegypti* in an urban setting like South Delhi. The predominance of coolers as larval habitats is attributable to their widespread use during summer and monsoon, coupled with inadequate maintenance and water stagnation. Similarly, plastic containers, often used for household storage, are prone to mosquito breeding due to their frequent placement in outdoor or peridomestic areas. The significant contribution of earthen pots and water tanks further reflects the role of traditional and modern water storage systems in supporting vector proliferation. Interestingly, tyres and cement cisterns, which are often highlighted in vector control campaigns, played a relatively minor role in this study area, possibly due to differences in local usage patterns.

Aedes aegypti, the principal vector of dengue, is well recognised as a "hydrophilic species'', meaning it thrives in humid environments. Because of this ecological preference, the mosquito has adapted to breed in water storage containers commonly found in domestic settings. During the rainy season, when temperatures drop and humidity rises, *Aedes aegypti* expands into peridomestic areas and breeds abundantly in both natural and man-made containers holding rainwater, resulting in a sharp increase in vector density.[14, 15] Reduction in dengue morbidity can be realised by strengthening outbreak prediction and detection systems through coordinated epidemiological and entomological surveillance. Furthermore, the promotion of integrated vector management, coupled with locally adapted control measures such as improved urban planning and effective household water management, remains essential.[16]

Developing an effective vector control strategy for any geographic area requires a thorough understanding of vector population dynamics.[17] Singh *et al.*[18] highlighted preventive measures such as emptying unused containers, modifying water storage practices, enforcing relevant laws, and strengthening community awareness through Information, Education, and Communication (IEC) activities. Similarly, Kumar *et al.*[19] emphasised the importance of intensifying vector surveillance at regular intervals, combined with source reduction by improving household water management. Abdalmagid *et al.*[20] recommended implementing systematic and sustained vector control programmes supported by IEC initiatives to bring down *Aedes aegypti* populations below the transmission threshold

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for dengue. Likewise, Leda Regis *et al.*[21] concluded that meaningful community participation remains the most effective approach to prevent *Aedes* breeding and sustain long-term control.

In the present study, the House Index (HI), Container Index (CI), and Breteau Index (BI) were recorded as 6.1%, 5.7%, and 9.7%, respectively. These values exceeded the transmission risk thresholds of HI >1, CI >1, and BI >5, thereby indicating the potential risk of dengue transmission in the study area. Comparable findings have been reported from other regions. For example, dengue vector surveillance in Thiruvananthapuram showed HI, CI, and BI values of 11.5%, 9.9%, and 5.19%, respectively, suggesting a high likelihood of an outbreak.[22] Similarly, research conducted in Bangalore to assess inter-epidemic risk in dengue-endemic rural areas reported indices of 12% (HI), 6.72% (CI), and 13.64% (BI).[23] A study from Pune involving larval surveys across 311 containers and 109 houses found indices of 7.3% (HI), 3.9% (CI), and 6.2% (BI per 100 houses), again confirming risk levels above thresholds.[24] Likewise, research conducted in Tirunelveli, Tamil Nadu, during a dengue outbreak recorded alarmingly high indices, 48.2% for HI, 28.6% for CI, and 48.2% for BI, underlining the importance of entomological surveillance in outbreak control.[25]

All the studies showed that the larval indices of *Aedes aegypti* were higher than the level of risk of transmission. This reinforces the need for a comprehensive and sustainable approach to dengue prevention. Such an approach should combine regular vector surveillance with integrated management practices, including safe and cost-effective biological and chemical interventions, environmental sanitation, supportive legislation, and active participation at both household and community levels.[26]

Conclusion

The larval surveillance in South Zone, Delhi, confirms the strong seasonality of *Aedes aegypti* breeding, with indices rising significantly during the monsoon months of July and August and declining thereafter. The study identifies August as the most critical period when all three indices, HI, CI, and BI, were at their highest, indicating maximum risk for dengue transmission. The analysis further reveals that the majority of breeding occurs in household water-holding containers, particularly coolers, plastic containers, and water tanks, highlighting domestic water storage as the most important determinant of vector density.

These findings underscore the urgent need for integrated vector management strategies that combine continuous larval surveillance with community-based source reduction. Specifically, interventions should prioritise cleaning and covering of coolers, safe storage of water in plastic and water containers, and behavioural changes in urban and peri-urban communities. While indices declined in the winter, the persistence of low-level breeding suggests that *Aedes aegypti* populations are never fully eliminated, necessitating year-round monitoring. Ultimately, this study concludes that sustainable dengue prevention in Delhi requires a combination of scientific surveillance, community awareness, and targeted elimination of the most productive container habitats. Such data-driven, seasonally aligned strategies hold the key to reducing the burden of dengue in endemic urban areas.

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References

1. Pang T, Mak TK, Gubler DJ. Prevention and control of dengue—the light at the end of the tunnel. The Lancet Infectious Diseases. 2017 Mar 1;17(3):e79-87. [Google Scholar]
2. \ Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL, Drake JM, Brownstein JS, Hoen AG, Sankoh O, Myers MF. The global distribution and burden of dengue. Nature. 2013 Apr 25;496(7446):504-7.[Google Scholar]
3. World Health Organization. Global strategy for dengue prevention and control 2012-2020. [Google Scholar]
4. Messina JP, Brady OJ, Golding N, Kraemer MU, Wint GW, Ray SE, Pigott DM, Shearer FM, Johnson K, Earl L, Marczak LB. The current and future global distribution and population at risk of dengue. Nature microbiology. 2019 Sep;4(9):1508-15. [Google Scholar]
5. Tsheten T, Gray DJ, Clements AC, Wangdi K. Epidemiology and challenges of dengue surveillance in the WHO South-East Asia Region. Transactions of The Royal Society of Tropical Medicine and Hygiene. 2021 Jun;115(6):583-99. [Google Scholar]
6. Ravish HS, Iswarya S, Ramya MP, Pradeep Kumar DP, Prajwal PH. Larval survey of Aedes aegyptifor predicting Dengue transmission. RGUHS National Journal of Public Health. 2019;4(2). [Google Scholar]
7. Jain S, Sharma SK. Challenges & options in dengue prevention & control: A perspective from the 2015 outbreak. Indian Journal of Medical Research. 2017 Jun 1;145(6):718-21. [Google Scholar]
8. Dev V, Khound K, Tewari GG. Dengue vectors in urban and suburban Assam, India: entomological observations. WHO South-East Asia journal of public health. 2014 Jan 1;3(1):51-9. [Google Scholar]
9. Focks DA. A review of entomological sampling methods and indicators for dengue vectors. [Google Scholar]
10. Rahman SJ, Jalees S, Sharma RS, Verghese T. Relevance of the Aedes Larval/House Index in predicting outbreaks of Dengue/Dengue Haemorrhagic Fever. [Google Scholar]
11. Singh A, Taylor-Robinson AW. Vector control interventions to prevent dengue: current situation and strategies for future improvements to management

of Aedesin India. Journal of Infectious Disease and Pathology. 2017 Feb 20;2(1):1-8. [Google Scholar]
12. Bowman LR, Runge-Ranzinger S, McCall PJ. Assessing the relationship between vector indices and dengue transmission: a systematic review of the evidence. PLoS neglected tropical diseases. 2014 May 8;8(5):e2848. [Google Scholar]
13. Geneva WH, World Health Organization. Dengue haemorrhagic fever: diagnosis, treatment, prevention and control. Geneva: World Health Organization. 1997. [Google Scholar]
14. Hettiarachchige C, Von Cavallar S, Lynar T, Hickson RI, Gambhir M. Risk prediction system for dengue transmission based on high resolution weather data. PloS one. 2018 Dec 6;13(12):e0208203. [Google Scholar]
15. Paul KK, Dhar-Chowdhury P, Haque CE, Al-Amin HM, Goswami DR, Kafi MA, Drebot MA, Lindsay LR, Ahsan GU, Brooks WA. Risk factors for the presence of dengue vector mosquitoes, and determinants of their prevalence and larval site selection in Dhaka, Bangladesh. PloS one. 2018 Jun 21;13(6):e0199457. [Google Scholar]
16. Begum AS, Alok S, Nessa S. Larval survey and spatial epidemiological analysis of vector Aedes aegypti to study the risk of dengue outbreak in India. GeoJournal. 2021 Feb;86(1):81-92. [Google Scholar]
17. Dixit V, Gupta AK, Kataria OM, Prasad GB. Population dynamics of Culex quinquefasciatus Filaria vector in Raipur city of Chhattisgarh state. Journal of communicable diseases. 2002 Sep 1;34(3):193-202. [Google Scholar]
18. Singh RK, Dhiman RC, Dua VK, Joshi BC. Entomological investigations during an outbreak of dengue fever in Lal Kuan town, Nainital district of Uttarakhand, India. Journal of Vector Borne Diseases. 2010 Sep 1;47(3):189. [Google Scholar]
19. Kumar RR, Kamal S, Patnaik SK, Sharma RC. Breeding habitats and larval indices of Aedes aegypti (L) in residential areas of Rajahmundry town, Andhra Pradesh. The Journal of communicable diseases. 2002 Mar 1;34(1):50-8. [Google Scholar]
20. MA A, Sh H A. Entomological investigation of Aedes aegypti in Kassala and Elgadarief states, Sudan. [Google Scholar]
21. Regis L, Souza WV, Furtado AF, Fonseca CD, Silveira Jr JC, Ribeiro Jr PJ, Melo-Santos MA, Carvalho MS, Monteiro A. An entomological surveillance system based on open spatial information for participative dengue control. Anais da Academia Brasileira de Ciências. 2009;81:655-62. [Google Scholar]
22. Sharma SN, Lal S, Saxena VK. Surveillance of dengue vector at thiruvananthapuram (Kerala) International Airport. The Journal of Communicable Diseases. 2004 Jun 1;36(2):136-43. [Google Scholar]
23. Isaacs N. Measuring inter epidemic risk in a dengue endemic rural area using Aedes larval indices. Indian Journal of Community Medicine. 2006 Jul 1;31(3):187. [Google Scholar]
24. Minhas S, Sekhon H. Entomological survey of dengue vector in an institutional campus to determine whether potential of dengue outbreak exists. International Journal of Medical and Applied Science. 2013;2(4):164. [Google Scholar]
25. Basker P, Kannan P, Porkaipandian RT, Saravanan S, Sridharan S, Kadhiresan M. Study on entomological surveillance and its significance during a dengue outbreak in the District of Tirunelveli in Tamil Nadu, India. Osong public health and research perspectives. 2013 Jun 1;4(3):152-8. [Google Scholar]
26. Constenla D, Armien B, Arredondo J, Carabali M, Carrasquilla G, Castro R, Durand L, Durán-Arenas L, García ME, Gallegos RV, Gontes ML. Costing dengue fever cases and outbreaks: recommendations from a costing dengue working group in the Americas. Value in Health Regional Issues. 2015 Dec 1;8:80-91. [Google Scholar]