Original Article

Entomological situation analysis for *Aedes*-borne diseases threat in rural Thiruvananthapuram, Kerala

R. Rajendran,[1] S.B. Anusree,[1] M.S. Sasi [2]

[1]National Centre for Disease Control, Ministry of Health and Family Welfare, Government of India, Thiruvananthapuram, [2]Directororate of Health Services, Government of Kerala, Thiruvananthapuram, Kerala, India

Corresponding author: R. Rajendran, Email: rajendran061@gmail.com

Received: 20/10/2025; Revised: 31/10/2025; Accepted: 12/11/2025; Published: 01/01/2026

Abstract

Kerala's diverse geo-climatic, environmental, and spatio-temporal conditions create a very congenial haven for a wide variety of pathogenic microorganisms and their vectors. This fosters the epidemiological convergence of disease-causing agents and vectors, enabling them to breed, proliferate, establish perpetual habitats, and cause various vector-borne diseases (VBDs). Of these VBDs, dengue accounts for the highest number of cases and fatalities, followed by chikungunya. Notably, the Thiruvananthapuram District has reported the highest incidence of dengue fever for over a decade. Since most studies on *Aedes*-borne diseases (ABDs) have focused on urban areas, specifically the Thiruvananthapuram Municipal Corporation area, an entomological situation analysis was conducted in rural areas to determine entomological indices that could provide critical and sufficient indications of the potential of VBDs outbreaks. This report presents the results and key inferences derived from the study, which may be helpful in implementing timely and effective preventive interventions by public health authorities.

Keywords: Adult premise index, *Aedes*-borne diseases, breeding preference ratio, Breteau index, container index, house index, vector-borne diseases, vector control.

Introduction

Newly emerging as well as re-emerging vector-borne diseases (VBDs) pose a formidable public health threat in Kerala especially during the last few decades. This contributes to the loss of many lives as well as socio-economic liabilities to individuals as well as families and the state exchequer. The public health system is in continuous strain especially due to sustained prevalence and frequent outbreaks of *Aedes* VBDs like dengue, chikungunya, and Zika. Kerala with its warm and humid tropical climate naturally provides an ideal environment for breeding and proliferation of mosquitoes. Moreover, rapid urbanization, accompanied by widespread consumeristic 'throw-away' habits among the general public, has created diverse and abundant breeding habitats for vector mosquitoes across the state. Consequently *Aedes*-borne disease (ABD) incidences are rapidly increasing in Kerala irrespective of rural-urban or geodemographic divides.[1]

In recent years, the onset of monsoon brings more fear than relief due to the apprehension of deadly epidemic outbreaks. Among these, dengue and chikungunya, the most dreaded fevers, have caused scores of deaths and incapacitated many victims with prolonged illness that prevents them from carrying out their

livelihood. Over the past two decades (2006 to 2024), the state of Kerala has experienced a high prevalence of dengue fever (DF), with a total of 1,12,144 confirmed cases and 661 deaths. There are also a significant number of unconfirmed cases of DF. Chikungunya has been a major health concern between 2006 and 2024, with 4,610 confirmed cases and 1,35,690 suspected cases. Kerala reported its first confirmed Zika case in July 2021, and a total of 118 laboratory- confirmed cases have since been recorded. The majority of Zka cases were from the Thiruvananthapuram district. This is notable because, although dengue and other ABDs are now widespread and almost endemic throughout Kerala, Thiruvananthapuram continues to be the most severely affected district.[2]

The adage 'prevention is better than cure' holds true, both individually and socially. For instance, checking the outbreak of devastating fevers in advance would be formidably advantageous for both safeguarding community health and saving the public exchequer. The prevalence and proliferation of dengue, chikungunya and Zika can only be checked or controlled through strategies focused on source reduction and vector management. Accordingly, motivated by the pressing need of the present situation, a comprehensive entomological situation analysis was undertaken in selected target areas of Thiruvananthapuram District, Kerala, to investigate the potential environmental factors contributing to the proliferation of vector mosquitoes and the increasing incidence of VBDs.

Materials and Methods

Target Area

A total of six rural panchayats in Thiruvananthapuram District were randomly selected for the study (Table 1 and Figure 1).

Study design

The aim of the study was to assess the dimensions and dynamics of vector mosquito activity in the target areas and to ascertain the possibility of any impending vector-borne disease (VBD) epidemic in the study areas. The study was carried out in over two phases. The first phase during April to May 2023 across three randomly selected panchayath areas: Malayinkeezhu, Kattakada and Kadinamkulam and the second phase during December 2023 in another three rural locations: Andoorkonam, Mangalapuram, and Pothencode. The number of randomly selected households chosen for the survey from each Panchayath is given in Table 1.

Entomological investigation

The entire household premises, both interior and exterior, was examined for two primary purposes: (1) to identify goods, materials, and circumstances that could serve as vector mosquito habitats, and (2) to collect direct evidence through the enumeration of immature stages (larvae and pupae) and adult mosquitoes. Standard

Table 1: Details of selected study areas in Thiruvananthapuram District

Surveys conducted / Panchayaths	No. of households searched
Household Survey-1:	
Malayinkeezhu (Ward Nos. I & II)	107
Kattakkada (Ward Nos. X &XI)	120
Kadinamkulam (Ward No. XI)	105
Household Survey-2:	
Andoorkonam (Ward Nos. V &VII)	120
Mangalapuram (Ward Nos. XII & XV)	100
Pothencode (Ward No. XII)	110

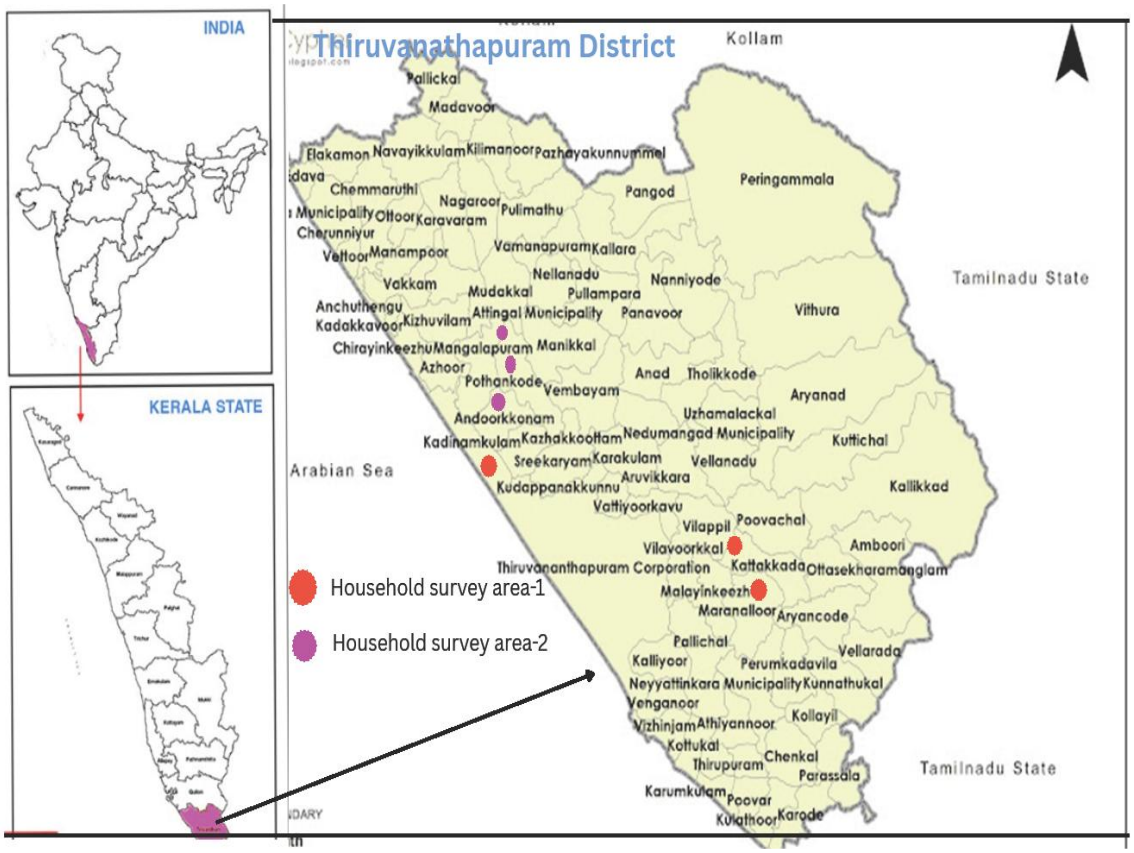


Figure 1: Study areas in Thiruvananthapuram District

scientific methods were employed to calculate various entomological indices.[3]

Potential containers searched included any natural, organic, or synthetic materials capable of holding water and accessible to gravid female *Aedes* mosquitoes. A larval survey was performed to identify and classify *Aedes* mosquito breeding habitats.[4] Active breeding habitats were defined as those containers that had immature stages (larvae, pupae, or both). The immature forms of mosquitoes were collected using devices appropriate to the container type, such as dippers, pipettes, and strainers.[4] Data on all containers were documented using a pre-designed proforma.

Field-collected immatures (larvae and pupae) were initially kept in separate, labelled vials and examined at the National Centre for Disease Control (NCDC) laboratory in Thiruvananthapuram. For immediate identification, approximately 10% of the fourth instar larvae were dissected, and their comb scales and pecten teeth were examined under a dissection microscope. The remaining larvae and all pupae were kept in separate rearing cages; and the adults that subsequently emerged were identified. The specimens were identified following standard keys.[5]

Field Protocol: Calculation of traditional Aedes larval indices

The data collected from the study were subsequently analysed to calculate standard entomological indices. *Aedes* larval indices thus calculated include the House Premises Index (HPI), Container Index (CI), and Breteau Index (BI). These indices were used to estimate infestation levels. In addition, the Pupal Index (PI), Adult *Aedes* Index (AAI), and Breeding Preference Ratio (BPR) were calculated for a complete assessment of the extent of vector mosquito prevalence and the resultant potential public health threat.

The various entomological indices were calculated using the following equations:

$$1.\ HPI = \frac{\text{Number of houses infested with } \textit{Aedes} \text{ immatures}}{\text{Number of total houses inspected}} \times 100$$

$$2.\ CI = \frac{\text{Number of containers positive for } \textit{Aedes} \text{ immatures}}{\text{Total number of containers checked}} \times 100$$

$$3.\ BI = \frac{\text{Number of containers positive for } \textit{Aedes} \text{ immatures}}{\text{Total number of houses inspected}} \times 100$$

The study also sought to estimate PI, AAI, and BPR. The PI is a key entomological measure used to evaluate the adult mosquito population, especially species that transmit diseases such as dengue. This index is a more accurate predictor of adult mosquito density than traditional larval indices. The AAI measures the *Aedes* mosquito population in a specific area. This crucial metric helps assess the level of infestation and guides the implementation of targeted vector control interventions. The following equations were used to calculate the PI and AAI:

$$1.\ PI = \frac{\text{Number of pupae collected}}{\text{Total number of houses inspected}} \times 100$$

$$2.\ AAI = \frac{\text{Number of house premises found positive for adult female } \textit{Aedes} \text{ mosquitoes}}{\text{Total number of houses inspected}} \times 100$$

The BPR measures a mosquito's preference for laying eggs in a specific container or habitat. To assess this, three indices for every breeding habitat were calculated, one for each container grouping category. The available containers index (ACI) is the ratio of the total count of a specific container type in each category to the overall number of containers found on the premises. The contribution index to breeding sites (CIB) represents the proportion of positive containers in each category compared to all positive containers present on the premises. [6] The BPR for each container type was determined by dividing CIB by ACI. A BPR value exceeding one indicates a stronger preference for that container type as a breeding site, while a value below one suggests that it is less preferred.

Information, Education, and Communication (IEC) intervention

The household survey has been complemented with an intervention activity involving awareness education programs and distribution of IEC materials among the target community.

Observations and Results

Household Survey - 1

During the first *Aedes* survey, only 9 of the 332-house premises searched in 3 randomly selected rural areas of Thiruvananthapuram District (Malayinkeezhu, Kattakkada, Kadinamkulam) were found positive for *Aedes* immatures, resulting in an overall HPI of 2.7%. A house premises is a specific type of premises used for residential purposes, encompassing a house along with its associated land, grounds, outbuildings, and other fixed structures.

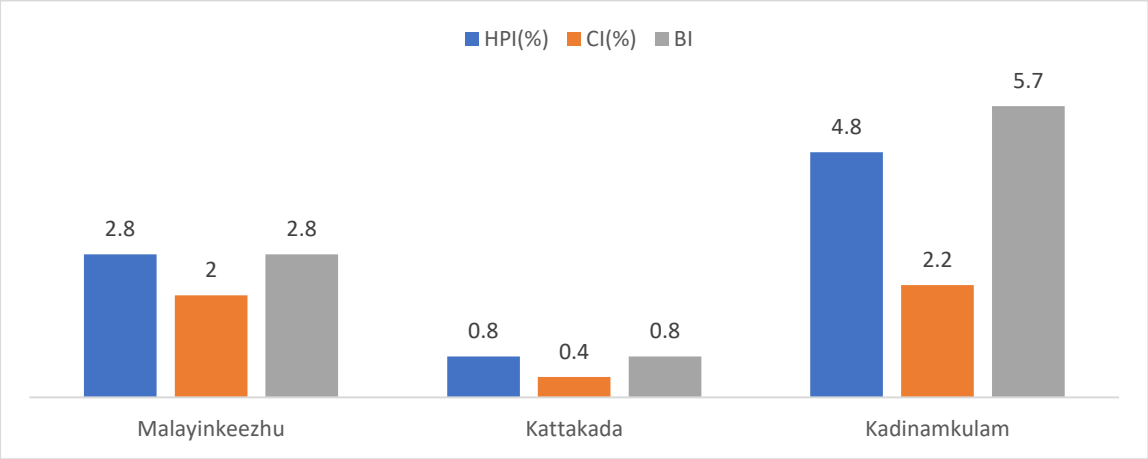
The locality-wise *Aedes* survey revealed the highest HPI in Kadinamkulam (4.8%), followed by Malayinkeezhu (2.8%), and Kattakkada (0.8%) (Table 2). Of the total 669 water-holding containers checked in the same Panchayath areas, only 10 were found to be positive for *Aedes* larvae/pupae, yielding an average CI of 1.49%.

The locality-wise evaluation indicated that the CI was highest in Kadinamkulam Panchayath area (2.2%), followed by Malayinkeezhu (2.0%), and Kattakkada (0.4%).

Panchayath-wise comparison revealed that Kadinamkulam Panchayath area recorded the highest Breteau index (5.7), significantly higher than Malayinkeezhu (2.8) and Kattakkada (0.8) (Table 2 and Figure 2).

Table 2: Household Survey - 1: Panchayath-wise entomological indices

Entomological indices	Name of the Panchayaths with Ward numbers		
	Malayinkeezhu (Ward Nos. I & II)	**Kattakkada (Ward Nos. X & XI)**	**Kadinamkulam (Ward No. XI)**
Number of house premises examined	107	120	105
House premises positive for *Aedes* immatures	3	1	5
Number of containers checked	152	247	270
Containers positive for *Aedes* immatures	3	1	6
House premises index in %	2.8	0.8	4.8
Container index in %	2.0	0.4	2.2
Breteau index in %	2.8	0.8	5.7
Pupal index in %	0.0	0.0	1.9
Adult premises index in %	0.0	0.0	1.0



HPI- House premises index, CI- Container index, BI- Breteau index

Figure 2: Household Survey-1: Panchayat wise entomological indices

Table 3: Household Survey - 1: Total containers examined vs. containers found positive

Containers	Name of the Panchayaths and Ward numbers					
	Malayinkeezhu (Ward Nos. I & II)		**Kattakkada (Ward Nos. X &XI)**		**Kadinamkulam (Ward No. XI)**	
	E	**P**	**E**	**P**	**E**	**P**
Earthen	40	1	65	1	51	0
Metal	25	1	43	0	44	0
Plastic/Leather	48	1	70	0	72	1
Grinding stones	2	0	5	0	3	1
Glass bottles/Glass tanks	6	0	14	0	41	0
Tyres	4	0	5	0	11	2
Cement tank	2	0	7	0	17	01
Fridge	13	0	17	0	19	1
Wells	12	0	21	0	12	0
Total	**152**	**3**	**247**	**1**	**270**	**6**

E=Examined, P=Positive for *Aedes* immatures

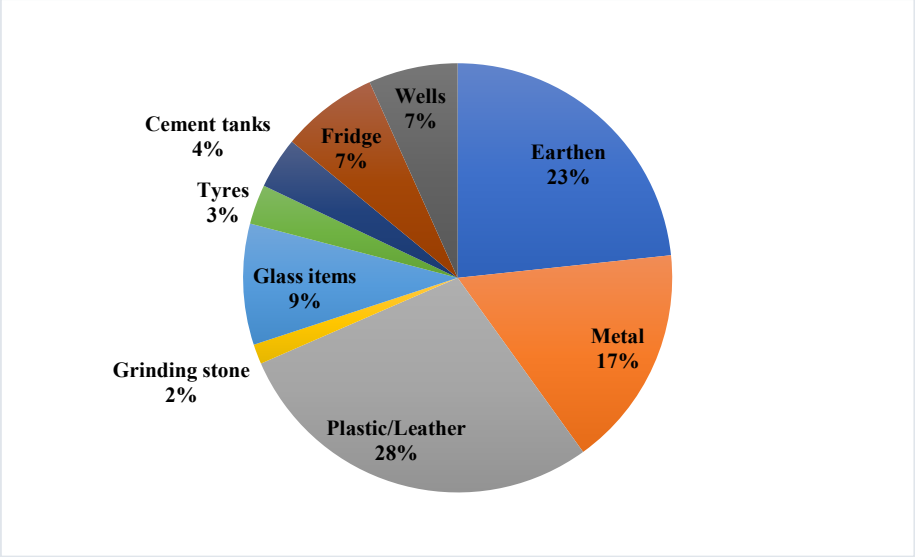
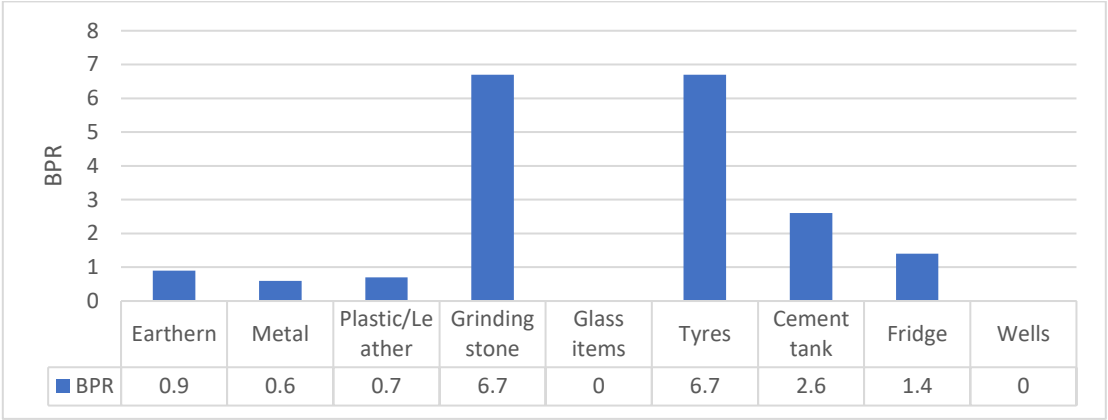


Figure 3: Proportionate distribution of various water-holding containers/sources identified during Household Survey-1

Table 4: Household Survey - 1: Breeding preference of *Aedes* mosquitoes in the target area

Type of Breeding sources	Examined		Positive for *Aedes* immatures		Breeding preference ratio
	No.	ACI (%)	No.	CIB (%)	CIB %/ACI %
Earthen	156	23.3	2	20.0	0.9
Metal	112	16.7	1	10.0	0.6
Plastic/Leather	190	28.4	2	20.0	0.7
Grinding stone	10	1.50	1	10.0	6.7
Glass items	61	9.1	0	0.0	0.0
Tyres	20	3.0	2	20.0	6.7
Cement tanks	26	3.9	1	10.0	2.6
Fridge	49	7.3	1	10.0	1.4
Wells	45	6.7	0	0.0	0.0

ACI= Available container index, CIB= Contribution index to breeding sites



BPR= Breeding preference ratio

Figure 4: Household Survey-1: Breeding preference ratio of *Aedes* mosquitoes in the target area

During the first household *Aedes* survey, pupae were found only in the Kadinamkulam Panchayath area, where the PI was 1.9%. No *Aedes* pupae were collected from the positive containers examined in the Malayinkeezhu and Kattakkada areas (Table 2).

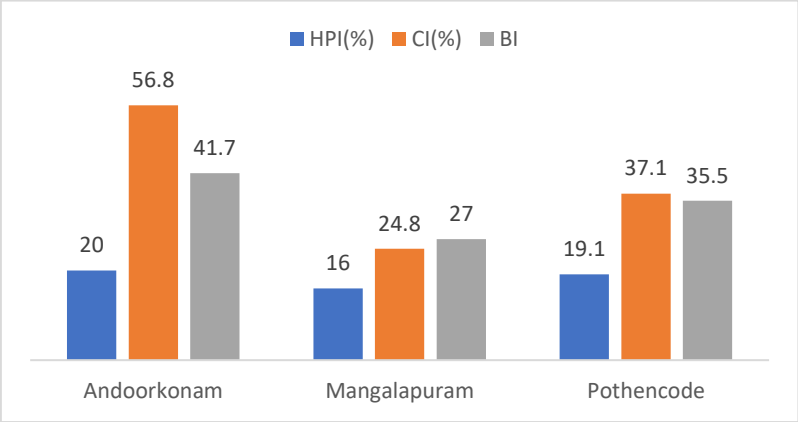
The different types of water-holding containers or sources found on household premises, including those positive for *Aedes*, are detailed in Table 3 for the selected localities. An examination of 669 water-holding containers /sources found scattered around the household premises of the surveyed areas revealed that plastic materials were the most common (28.4%), followed by earthen containers (23.3%), metal objects (16.7%) and glass items (9.1%), with other materials making up the remainder (Figure 3).

It was found that the laboratory-reared adult mosquitoes and wild-caught specimens from the specified localities revealed the presence of only *Aedes albopictus*. This finding is further supported by the fact that no *Aedes aegypti* larvae or pupae were found in any containers across the surveyed area.

From Household survey-1, it was observed that *Aedes albopictus* mosquitoes preferred to breed in tyres and grinding stones (BPR 6.7 each). Cement tanks (2.6) and fridges (1.4) were less preferred breeding sites (Table 4 and Figure 4).

Table 5: Household Survey- 2: Panchayath-wise entomological indices

Field activities	Name of the Panchayaths (Ward numbers)		
	Andoorkonam (Ward Nos. V, VII)	**Mangalapuram (Ward Nos. XII & XV)**	**Pothencode (Ward No. XII)**
Number of house premises examined	120	100	110
House premises positive for *Aedes* immatures	24	16	21
Number of containers checked	88	109	105
Containers positive for *Aedes* immatures	50	27	39
House premises index in %	20.0	16.0	19.1
Container index in %	56.8	24.8	37.1
Breteau index in %	41.7	27.0	35.5
Pupal index in %	21.7	14.0	12.7
Adult *Aedes* Index in %	11.7	14.0	14.5



HPI- House premise index, CI- Container index, BI- Breteau index

Figure 5: Household Survey -2: Panchayath-wise entomological indices

Table 6: Household Survey - 2: Total containers examined vs. containers found positive

Containers	Name of the Panchayaths and Ward Numbers					
	Andoorkonam (Ward Nos. V, VII)		Mangalapuram (Ward Nos. XII &XV		Pothencode (Ward No. XII)	
	E	P	E	P	E	P
Earthen	19	12	8	4	29	11
Metal	9	7	5	3	14	3
Plastic/Leather	43	20	44	19	37	15
Grinding stones	0	0	1	0	4	3
Glass bottles/Glass tanks	11	5	50	0	8	2
Tyres	2	2	1	1	4	3
Cement tank	2	2	0	0	3	1
Fridge	2	2	0	0	6	1
Total	**88**	**50**	**109**	**27**	**105**	**39**

E=Examined, P=Positive

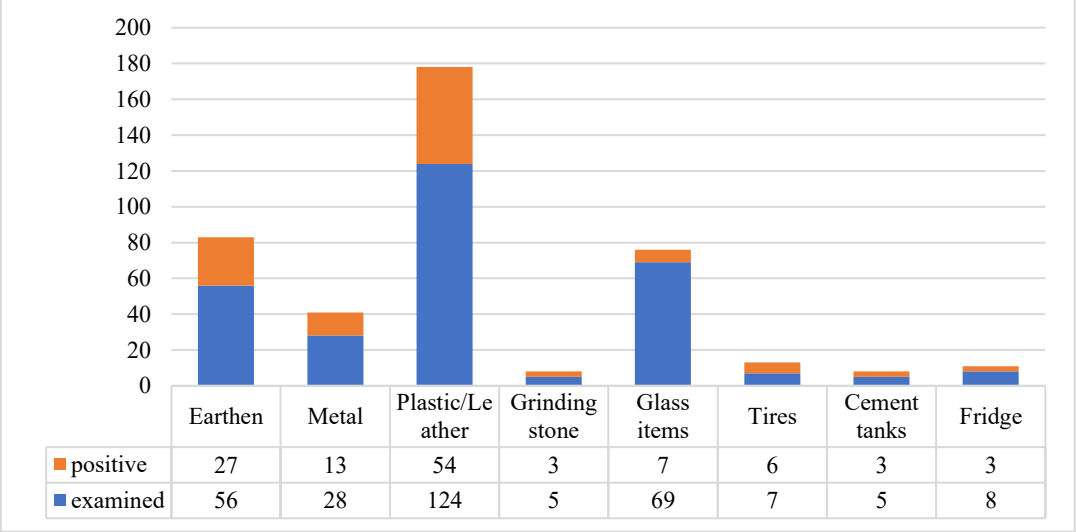
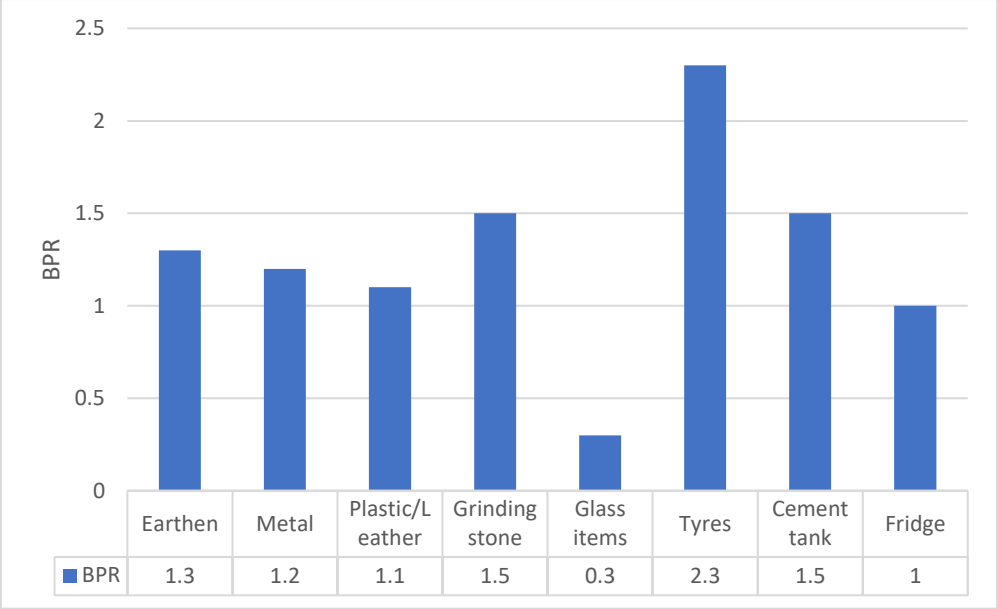


Figure 6: Household Survey -2: Types of water-holding containers examined, showing the proportion of each that tested positive for Aedes immatures

Table 7: Household Survey - 2: Breeding preference of *Aedes* mosquitoes in the target area

Type of Breeding sources	Examined		Positive for *Aedes* immatures		Breeding preference ratio
	No.	ACI (%)	No.	CIB (%)	CIB %/ACI %
Earthen	56	18.5	27	23.3	1.3
Metal	28	9.3	13	11.2	1.2
Plastic/Leather	124	41.1	54	46.6	1.1
Grinding stone	05	1.7	03	2.6	1.5
Glass items	69	22.9	07	6.0	0.3
Tyres	07	2.3	06	5.2	2.3
Cement tanks	05	1.7	03	2.6	1.5
Fridge	08	2.7	03	2.6	1.0

ACI= Available container index, CIB= Contribution index to breeding sites



BPR=Breeding preference ratio

Figure 7: Household Survey - 2: Breeding preference of *Aedes* mosquitoes in the target area

Household survey - 2

In the three sample wards, 18.5% of the surveyed households were at high risk of mosquito-borne diseases, being *Aedes*-positive as indicated by containers holding mosquito immatures. Andoorkonam Panchayath showed the highest positivity rate (HPI-20%), while Pothencode and Mangalapuram Panchayaths reported successively lower, but still significant rates (Table 5). The CI was high across the entire area. The highest CI was recorded in Andoorkonam (56.8%), followed by Pothencode (37.1%), and Mangalapuram (24.8%). A moderately high BI was observed in both the Andoorkonam and Pothencode Panchayath areas, while the BI in Mangalapuram (Ward Nos. XII andXV) was the lowest of the three (Table 5 and Figure 5).

The different types of containers/sources found on house premises, by locality, are presented in Table 6. Of the total 302 water-holding containers examined for *Aedes* breeding, Mangalapuram Panchayath accounted for the largest share at 36.1%, followed closely by Pothencode (34.8%), and then Andoorkonam (29.1%). The different types of water-holding containers examined, and the proportion of each found positive for *Aedes* larvae and pupae, are presented in Figure 6.

Out of the 116 *Aedes*-positive containers found during the post-monsoon survey in selected Thiruvananthapuram Panchayath areas, 92.3% (114 containers) contained *Aedes albopictus* immatures. The remaining 1.7% (2 containers) were positive for *Aedes vittatus* larvae. Species identification was confirmed by microscopic examination of fourth instar larvae and validated by observing the emerged adult mosquitoes from rearing cages. Neither the immatures nor the adults of *Aedes aegypti* were detected in this study.

In the Household survey-2, *Aedes albopictus* in the selected localities showed a clear breeding preference for tyres (2.3%), followed by cement tanks and grinding stones (1.5% each) (Table 7 and Figure 7).

Discussion

Aedes-borne diseases, primarily dengue, chikungunya and Zika, pose a significant and growing public health threat in Kerala,

across urban, peri-urban, and rural areas. The emergence and re-emergence of ABDs in Kerala are driven by a combination of environmental, demographic, and socio-economic factors that collectively foster ideal conditions for mosquito breeding and disease transmission. [7] The year-round warm, humid climate, coupled with extensive agricultural practices and increasing urbanization, contribute to a highly favourable environment for the breeding and proliferation of *Aedes* mosquitoes in Thiruvananthapuram District.

A high population density, irrespective of urban-rural divide, results in people living in close proximity to mosquito breeding areas. This problem is compounded by the improper disposal of solid wastes, especially non-degradable plastics, which creates innumerable new habitats for *Aedes* mosquitoes. For more than two decades, recurring outbreaks of ABDs, such as dengue and chikungunya, have posed significant public health challenges for Kerala state, particularly in the Thiruvananthapuram District. In Kerala, the Zika virus infection was first reported in Thiruvananthapuram in 2021. Since then, the state has reported over a hundred cases, with the majority concentrated in the state capital, adding to an already precarious ADB situation. [8]

Thiruvananthapuram District, with the rest of Kerala, experiences four distinct seasons: a pre-monsoon period of hot and humid weather (March to May); the Southwest Monsoon (June to September), which brings heavy rains; the Northeast Monsoon (October to November) and a post-monsoon season (December to February) with cold and pleasant weather. During the first household *Aedes* survey, conducted in selected localities in Thiruvananthapuram District, 669 water-holding containers were identified on house premises. Scattered summer showers during the survey period (April-May 2023) resulted in the accumulation of standing water in many of the containers. This, coupled with poor adherence to household source reduction or container emptying practices, likely led to the increased number of water-holding sites. While the average number of water-holding containers per household premises was 2.02, the rate of *Aedes* positive containers per house remained low at 0.03. This marked discrepancy suggests that scattered rains, household water storage, and plant-watering on non-rainy days probably contributed to the observed increase in the number of water-filled containers on the premises. However, the combination of infrequent rainfall, hot weather, and high evaporation during dry periods probably deterred the *Aedes* mosquitoes from ovipositing and further proliferation.

Traditional *Aedes* larval indices, or *Stegomyia* indices, are significant tools for public health, as they provide a quantitative metric for assessing potential disease vector habitats and are crucial for predicting the risk of dengue and other ABDs. The PI and AAI are key entomological tools used to estimate the risk of disease transmission for *Aedes*-borne diseases such as dengue, chikungunya, and Zika. The PI, which measures the number of pupae in an area, provides a more accurate prediction of possible adult mosquito populations and disease transmission risk, compared to other larval indices. The AAI measures the percentage of premises containing adult female *Aedes* mosquitoes and serves as a direct indicator of current, immediate risk of disease transmission, since only female mosquitoes bite and transmit pathogens. In the present study, all the entomological indices-including house premises, container, Breteau, pupal, and adult *Aedes* indices, were significantly high, *i.e.,* above the critical threshold [9] in all the surveyed localities during the month of December. This finding is directly attributed to the preceding Northeast monsoon (mid-October to November), as this period is considered the most favourable for the

breeding and proliferation of *Aedes* mosquitoes, particularly *Aedes albopictus*, leading to a substantial increase in mosquito population. A recent study indicated the significant role of rainfall in dengue incidence in Thiruvananthapuram District, suggesting the need for intensified vector surveillance and control activities during the monsoon season. [10] Entomological surveillance in Alappuzha District demonstrated a noteworthy seasonal difference in *Aedes* larval indices, with higher HPI, CI and BI recorded during the post-monsoon period, compared to the pre-monsoon period across both urban and rural areas.[11]

The present study on *Aedes* mosquito biology, ecology, and population dynamics in the Thiruvananthapuram Corporation area revealed a high prevalence of *Aedes albopictus*, with comparatively low collection numbers for both *Aedes aegypti* and *Aedes vittatus*. Furthermore, the overall *Aedes* mosquito population peaked during the monsoon season, which may be attributed to the increased availability of breeding sites during rainy days. [12] A recent retrospective spatio-temporal analysis of dengue cases, utilizing public domain data from the Directorate of Health Services, Kerala, identified ten high-priority dengue epidemic risk districts. Among these, Thiruvananthapuram exhibited the highest relative risk.[13] For assessing dengue risk in Thiruvananthapuram District, the AHP and F-AHP models identified a total of 20 localities as risk zones.[14] The Panchayaths of Kadinamkulam, Kattakkada, Malayinkeezhu, and Mangalapuram, in particular, were designated as very high-risk areas for dengue. It is worth noting that four of these high-risk localities were randomly included in the present study.

Larval identification and the examination of laboratory-reared and wild-caught adult mosquitoes consistently showed that *Aedes albopictus* was the most prevalent species found in all surveyed localities, during both the pre-monsoon and post-monsoon periods. Notably, no *Aedes aegypti* immatures were found in any containers. An investigation of domestic and environmental factors associated with chikungunya-affected families in rural Thiruvananthapuram revealed that the majority of study areas presented highly favourable breeding conditions for *Aedes albopictus* mosquitoes. [15]

The household survey showed a seasonal shift in the BPR, with the pre-monsoon observation highlighting grinding stones and tyres with the highest BPR (6.7 each), followed by cement tanks at 2.6. In the post-monsoon period, tyres were observed to be the most preferred site with a BPR of 2.3, followed by cement tanks and grinding stones, which shared a BPR of 1.5 each. Despite the change in order, it is noteworthy that the same three sites (tyres, cement tanks, and grinding stones) remained the most preferred breeding sites of *Aedes albopictus* in both seasons. The high BPR observed in the present study validates previous findings in Thiruvananthapuram District that discarded tyres and grinding stones are the most preferred container breeding sites for *Aedes* mosquitoes, especially *Aedes albopictus*.[16] Surveillance of *Aedes* mosquitoes around Cochin International Airport area revealed that BPR was highest in tyres, followed by grinding stones and cement tanks, as observed in the present study.[17] Caution must be exercised when interpreting BPR from infrequently encountered container types; however, the extensive field data in the present study validated this apparent preference for the specific artificial sites.

Previous entomological surveys in Thiruvananthapuram District established a pattern in which *Aedes aegypti* was confined to urban areas, while *Aedes albopictus* was found breeding profusely in both rural and urban localities. However, more recent surveys indicate a significant decline, or even absence of *Aedes aegypti* in the district's urban areas.[8] The reason

for this shift in the *Aedes* vector breeding profile warrants detailed investigation. The throwaway habit, characteristic of the consumeristic culture originally confined to urban centres, is rapidly spreading across Kerala. This diffusion is facilitated by pervasive urbanization, which has blurred the traditional urban–rural distinctions. Scattered heaps of litter, comprising non-degradable plastic, metal items and various scraps, are a common sight in household premises, marketplaces, public spaces, parks, and along roadsides. These materials retain water for long periods, providing an ideal breeding environment for mosquito vectors, especially *Aedes* species.

The best strategy for *Aedes* vector control and averting outbreaks of diseases such as dengue is pre-monsoon source reduction with active community participation. However, it is observed that public health warnings, though regularly issued by authorities, are often not followed by the public. This persistent non-compliance necessitates a fundamental shift in approach both from the community and the public health authorities. The community must transition from negligence to proactive behaviour through regular measures to eliminate mosquito breeding sites in and around households and public areas. Meanwhile, public health authorities must evolve their role from issuing occasional media announcements to ensuring sustained, participatory intervention programmes involving multiple stakeholders, including residents, local organizations, and community health workers. Successful management of any public health challenge, comprising prevention and control of vector-borne diseases, requires a participatory intervention strategy. Active engagement of the community, involving residents' associations, and other stakeholders at various levels is vital, as this multi-level involvement ensures the sustained commitment necessary for long-term primary prevention.

Conclusion

The present entomological study revealed a high prevalence of *Aedes* mosquito immatures in household premises, particularly during the post-monsoon season. This finding, coupled with the confirmed presence of female *Aedes* mosquitoes in the area, significantly heightens the risk of ABD outbreaks and calls for immediate action by the authorities as well as the inhabitants to control mosquito proliferation by eliminating natural and man-made breeding habitats, particularly the sources of standing water and to forestall VDB outbreaks. Routine health education, driven by community participation, is essential for promoting positive behavioural changes that improve personal hygiene, sanitation, and environmental management. Active collaboration involving Non-Governmental Organizations, Community-Based Organizations like Residents' Associations, and social work agencies is crucial for the successful implementation of vector and disease control programmes.

Acknowledgement

We extend our sincere gratitude to the Director of the National Centre for Disease Control, Ministry of Health and Family Welfare, Government of India, for his valuable support. We would also like to express our thanks to the Director of Health Services, Government of Kerala, for the support in execution of this work.

Financial support and sponsorship

Nil

Conflicts of interest

There are no conflicts of interest

References

1. Rajendran R, Anusree SB, Sasi MS, Sheela Devi D, Regu K. Current Status of Communicable Diseases – International, National and Kerala Scenarios. *Journal of Communicable Diseases* 2025; 57(1):167-84.
2. Data on Communicable Diseases. State Surveillance Unit, Directorate of Health Services, Kerala, Thiruvananthapuram. Available from:

https://dhs.kerala.gov.in. [Last accessed on 2025 Sep 01].
3. World Health Organization. Guidelines for dengue surveillance and mosquito control. 2nd Edition. Manila: WHO Regional Office of Western Pacific. 2003. Available from: https://iris.who.int/server/api/core/bitstreams/909976c3-2768-46ca-9fca-55e2a7420d75/ content. [Last accessed on 2025 Sep 05].
4. National Centre for Vector Borne Diseases Control (NCVBDC). Compendium on Entomological Surveillance & Vector Control in India. Delhi: Directorate General of Health Services, Ministry of Health & Family Welfare, Govt of India. 2016. pp 1-57. Available from: https://ncvbdc.mohfw.gov.in/WriteReadData/l892s/Compendium-Entomological-Surveillance&Vector-Control-India.pdf. [Last accessed on 2025 Sep 08].
5. World Health Organization. Pictorial identification key of important disease vectors in the Who South-East Asia Region. Switzerland: WHO. 2020. Available from: https://kohasri.searo.who.int. [Last accessed on 2025 Sep 10]
6. Garjito TA, Hidajat MC, Kinansi RR, Setyaningsih R, Anggraeni YM, Mujitanto, et al. *Stegomyia* indices and risk of dengue transmission: a lack of correlation. *Frontiers in Public Health* 2020; 24(8): 328.
7. Devi DS, Rajendran R, Pillai MS. Diversity of *Aedes* larval habitats in rural and urban areas of Malappuram District. *Entomon* 2012; 37(1-4): 31-49.
8. Rajendran R, Baruah K, Anusree SB, Sasi MS. Entomological Surveillance and Risk Assessment for *Aedes*-borne diseases in the Premises of Medical College Campus Institutions in Thiruvananthapuram Municipal Corporation. *Journal of Communicable Diseases* 2025;57(3):14-24.
9. Pan American Health Organization. Dengue and Dengue Hemorrhagic Fever in the Americas: Guidelines for Prevention and Control. Washington DC: Pan American Health Organization. 1994. Available from: https://www.paho.org/sites/default/files/Dengue-and-and-dengue-hemorrhagic-fever-in-the-americas%2C-guidelines-for-prevention-and-control--1997.pdf. [Last accessed on 2025 Sep 10].
10. Nair DG Aravind NP. Association between rainfall and the prevalence of clinical cases of dengue in Thiruvananthapuram district, India. *International Journal of Mosquito Research.*2020;7(6):46-50.
11. Rajendran R, Anusree SB, Regu K. Seasonal variation and breeding preference of Aedes albopictus in one of the coastal districts of Kerala. *International Journal of Mosquito Research* 2019; 7(4):78-82.
12. Mathew M. Some Aspects of the Biology, Ecology and Population Dynamics of *Aedes* Mosquitoes in Thiruvananthapuram Corporation, Kerala [Doctoral Dissertation], Thiruvananthapuram: University of Kerala. 2004..
13. Nayak MS, Narayan K. Spatio-Temporal Analysis of Dengue Fever cases: A Retrospective Study. *Journal of Clinical and Diagnostic Research* 2020;14(4):LC05-LC08.
14. Harsha G, Anish TS, Rajaneesh A, Prasad MK, Mathew R, Mammen PC, et al. Dengue risk zone mapping of Thiruvananthapuram district, India: a comparison of the AHP and F-AHP methods. *Geojournal* 2023; 88:2449-70.
15. Anish TS, Vijayakumar K, Amma LK. Domestic and environmental factors of chikungunya-affected families in Thiruvananthapuram (Rural) district of Kerala, India. *Journal of Global Infectious Diseases* 2011; 3(1):32-6.
16. Vijayakumar K, Sudheesh Kumar TK, Nujum ZT, Umarul F, Kuriakose A. A study on container breeding mosquitoes with special reference to *Aedes* (*Stegomyia*) *aegypti* and *Aedes albopictus* in Thiruvananthapuram district, India. *Journal of Vector Borne Diseases* 2014; 51(1): 27-32.
17. Rajendran R, Regu K, Anusree SB, Tamizharasu W, Rajendran A. Surveillance of *Aedes* (*Stegomyia*) mosquitoes in and around International Airport, Kerala- Assessment of vector control efforts. *Entomon* 2020; 45(2): 135-42.

How to cite this article: Rajendran R, Anusree SB, Sasi MS. Entomological situation analysis for *Aedes*-borne diseases threat in rural Thiruvananthapuram, Kerala. Journal of Experimental Biology and Zoological Studies 2026;2(1):53-65.