REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:

Studies On Larval Breeding Habitats And Survival Indicators Of *Aedes*Mosquitoes In Selective Plantation Sites Of Kanyakumari District, South India

Sony X. Vincent[1*], E. Grace Marin[2]

[1*,2] Department of Zoology and Research Centre, Scott Christian College (Autonomous), Affiliated to Manonmaniam Sundaranar University, Tirunelveli; Nagercoil – 629003, *Email: samuelsony2006@gmail.com

Abstract
Mosquitoes are responsible for transmitting many pathogens that cause dengue, chikungunya, west Nile, filariasis, Japanese Encephalities and Zika diseases. Both *Aedes aegypti* and *Aedes albopictus* are responsible for dengue transmission in Kanyakumari district. *Aedes albopictus* are found abundant in rural areas and *Aedes aegypti* are abundant in urban areas. These mosquitoes are container breeders and they usually breed in buckets, drums, plastic containers, used tires, mud pots, discarded containers, coconut shells, etc. The larval surveys were done in villages Vadakkanadu and Poovancode which are surrounded by rubber plantations. In Kanyakumari district both rubber and coconut are the major cash crops. In the rubber plantations, coconut shells and plastic cups are used to collect latex from the rubber trees. Here the major sources of larval breeding are rubber tapping cups, coconut shells, plastic buckets, aluminum dishes, glass bottles, overhead tanks and drums, tin cans, etc. The larval surveillance indicators revealed a high risk of dengue outbreak. Knowledge of the breeding habitats and sources in different ecosystem help us to implement appropriate control measures though larval control. Elimination of the mosquito breeding sources by removing collected waters in and around the houses and educating the people are important tools for dengue control.

Keywords: *Aedes* mosquitoes, rubber plantations, breeding sources, HI, CI, BI

Introduction

Mosquitoes are vectors that transfer arboviruses and cause various mosquito borne diseases and hence pose a threat to community health. The role of *Aedes aegypti* and *Aedes albopictus* in the transmission of dengue and chikungunya viruses were well documented. Dengue fever is receiving lot of attention from health departments and researchers after the major outbreak of Denue fever during 1996 in Delhi (Anuiradha*et al;* 1998). Dengue spreads throughout the tropical and subtropical regions (Gubler, 1998).*Aedes aegypti* has tremendous biting ability than *Aedes albopictus*, both species are well adapted to oviposit in smaller containers that has water in it (Kolivras,2006; Winchester,2011). Several data shows that urban areas are highly effective breeding sites for mosquitoes which increase the likelihood of disease transmission (Lindsay *et al*, 2017). Studies show that human ecology, habits and behavior greatly influence mosquito distribution, species relative abundance and survival (Evans, 1938). Reinfestation of vectors to new geographical areas, warm and humid climate, water storage patterns, increased population density, storage of trash like tires and introduction of new serotype of the virus serve as risk factors for dengue infections (Chaturvedi, 2008). *Aedes aegypti* is the most efficient vector for arbovirus because it is highly anthropophilic, frequent bites and thrives in close proximity to humans (WHO, 2009).

Rubber plantations are considered to be the potential breeding grounds of mosquitoes especially *Aedes* species. *Aedes* mosquitoes have the ability to withstand drought climatic conditions. The high density of *Aedes* mosquitoes determines the high risk of Dengue in that area. *Aedes* mosquitoes breed both indoor and outdoor. Sources of breeding sites include coconut shells and plastic cups which are used to collect latex, leaf axils, dry leaves, ice apple shells, unused tires, aluminium trays, buckets, stone grinders, drip trays, indoor plants, plant pots, broken earthen pots, shoes, water storage tanks, toys, tree holes, tarpaulin sheets, fridge trays, glass bottles, etc. The container breeders like *Aedes* mosquito species are known to follow visual or olfactory cues to appropriate water containers and then use both physical and chemical factors in the water for selecting it for oviposition (Muir,1988).Deforestation, climate change and increase in global trade have made the mosquitoes adapted to breeding in domestic and semi-domestic artificial habitats (Gubler *et al*, 2001; Delatte *et al*, 2008). Identification of breeding sources regularly and removing it is the only feasible method in vector control (Ferdousi *et al*, 2015). The present work was carried out to study the various breeding sites of mosquitoes in villages likeVadakkanadu andPoovancodeand in turn reducing the sources of breeding sites for the management of mosquitoes.

Methodology

An entomological survey was carried out from August 2022 to December, 2022 in villages surrounded by rubber plantations. Vadakkanadu and Poovancode are villages which are surrounded by rubber plantations, situated in Kanyakumari district.Kanyakumari district is located in the southern tip of peninsular India which has favorable climatic conditions for mosquitoes. Larval survey was conducted both indoors and outdoors of 504 houses. The total number of

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:

containers inspected and the positive containers for the larva were recorded. *Aedes* larval breeding indices were calculated according to the NVBDCP guidelines.
House Index (HI) = No. of houses positive/ No. of houses inspected x 100
Container Index (CI) = No. of containers positive / No. of containers inspected x 100
Breteau Index (BI) = No. of containers positive/ No. of houses inspected x 100
The tools used for this survey are plastic containers, flash lights, enamel trays, net, net cage, yeast powder, biscuit. Larvae and pupa were collected from the breeding sites and transferred to the wide mouth plastic container which has tiny holes on the top. Then it is transferred to the enamel trays to segregate the *Aedes* larvae. *Aedes* larvae were identified using taxonomic key. Unidentified larvae are fed with little amount of yeast and small quantity of biscuit powder and kept in net cages. Pupae were also transferred it to the cage until its emergence. Emerged mosquitoes were then identified with their morphological features (Das and Kaul 1998; Madzian*et al*, 2016)

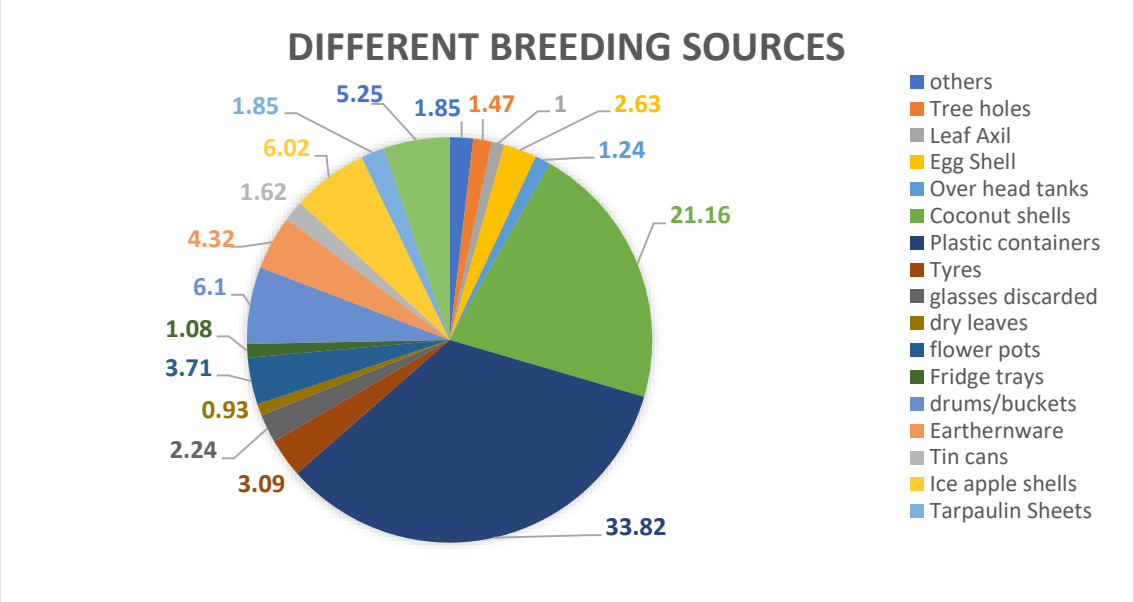
Results

A total of 504 houses were surveyed over a period of five months and 247 houses were found infested (Table 1). Total of 2090 containers both indoors and outdoors were inspected and 498 containers were positive for *Aedes* (Table 1). Larvae and pupae were found in the containers. The main potential source of containers is discarded plastic containers (33.82 %), coconut shells (21.16%) followed by water storage drums and plastic buckets (6.10%) (Figure 1). The study areas show highest House Index (69%), Container Index (30.70) and Breteau Index in the month of November. All the indices are above the critical level and thus there is the possibility of the outbreak of mosquito borne diseases. After latex collection, coconut shells and plastic cups are kept in upright position. Water gets collected and act as major breeding source of mosquitoes. Many houses that are close to the rubber plantations use common overhead tank to store water, along with this they store water in plastic pots, buckets and drums. Uncovered pots and improper cleaning of these containers also serve as breeding sources. Aluminum trays (5.25%) which are used to set latex collect plenty of water during monsoon and larvae and pupae are found abundant during the offset of monsoon. During monsoon season, tree holes (1.47 %), dry leaves (0.93%) and leaf axil (1 %) are also acting as natural breeding sources as there are plenty of plantations in this area. Other than these, stone grinders, egg shell, tires, glass bottles, flower pots, fridge trays, earthen wares, tin cans, tarpaulin sheets and ice apple shells also play a role in mosquito breeding.

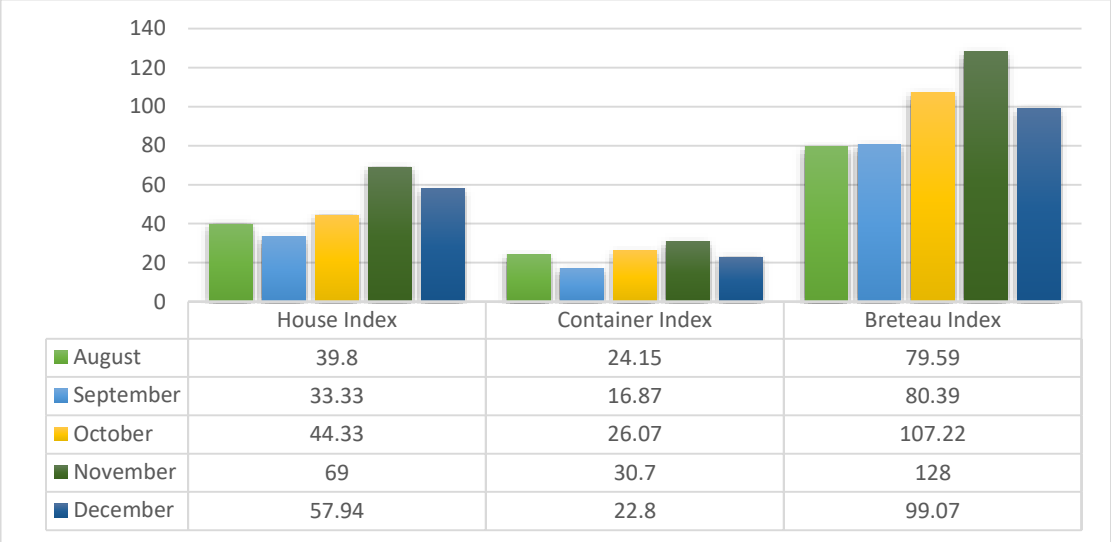
Table 1: Breeding sources of *Aedes* mosquitoes

	August	September	October	November	December
Number of houses surveyed	**98**	**102**	**97**	**100**	**107**
Number of infested houses	**39**	**34**	**43**	**69**	**62**
Number of containers	**323**	**486**	**399**	**417**	**465**
Number of positive containers	**78**	**82**	**104**	**128**	**106**
House Index	**39.8**	**33.33**	**44.33**	**69**	**57.94**
Container Index	**24.15**	**16.87**	**26.07**	**30.70**	**22.80**
Breteau Index	**79.59**	**80.39**	**107.22**	**128**	**99.07**

Figure 1: Different breeding sources



REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:



	House Index	Container Index	Breteau Index
August	39.8	24.15	79.59
September	33.33	16.87	80.39
October	44.33	26.07	107.22
November	69	30.7	128
December	57.94	22.8	99.07

Figure 2 : Trend in larval indices over the five months

Discussion

The most common breeding sources in the study areas are plastic containers and coconut shells; these are commonly found abundant as these are used to collect latex. During monsoon and post monsoon season these coconut shells and plastic cups collect water and thus serve as a major breeding source for mosquitoes (Figure 1). *Aedes* mosquitoes are known to breed in fresh water stored in different types of containers. Rubber plantation use coconut shells to collect rubber latex and it play a major role in population dynamics of this mosquito (Sumodan, 2008). Coconut shells discarded after using the kernel for cooking, collect water during monsoon (Tyagi and Dash, 2006). Some studies have shown that water chemistry and presence of certain nutrient concentrations are important determinants for the female mosquitoes to oviposit and for the further development of the larvae and pupa (Piyaratne*et al*, 2005). High nutrient content in the coconut shells may have attracted more female mosquitoes to oviposit (Chatterjee*et al*, 2015). Along with these parameters, temperature and pH also plays a major role in mosquito breeding. Improper cleaning and covering of water containers which acts as a breeding place increases the population of mosquitoes, thus people in this area are highly prone to mosquito borne infection. Hanging pots in the garden, indoor plants, drip trays and fridge trays were left unnoticed. Apiaries near the residential areas use tarpaulin sheets to cover the bee hives. During monsoon season water gets collected in this and acts as a major breeding spots. Close monitoring and periodic change of water may decrease the breeding sources. More than natural sites *Aedes* breeding spots are high in artificial containers.

Conclusion

Identification of breeding sources regularly and removing it is the only feasible method in vector control (Ferdousi *et al*, 2015). Our entomological survey shows that eradication of artificial mosquito breeding sources may reduce the risk of mosquito borne diseases to greater extent. Our study shows that natural sources played a minor role in mosquito breeding. Control of mosquitoes can be done either through enforcing some form of laws or by public health education.

Acknowledgement

We gratefully acknowledge our college management that permits us to carry out the work. We also thank the people of Vadakkanadu and Poovancode who participated in the study.

Conflicts of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

References

1. Anuradha S, Singh NP, Rizvi SN, Agarwal SK, Gur R, Mathur MD. The 1996 outbreak of dengue hemorrhagic fever in Delhi, India. *Southeast Asian J Trop Med Public Health*. 1998;29(3):503-506.
2. Chatterjee S, Chakraborty A, Sinha SK. Spatial distribution & physicochemical characterization of the breeding habitats of *Aedes aegypti* in & around Kolkata, West Bengal, India. *Indian J Med Res*. 2015;142 Suppl(Suppl 1):S79-S86. doi:10.4103/0971-5916.176631
3. Chaturvedi,U.C.,Nagar,R. Dengue and denguehaemorrhagicfever:Indian perspective. *J Biosci* 33, 429–441 (2008). https://doi.org/10.1007/s12038-008-0062-3

4. Das Bina Pani, Kaul SM. Pictorial key to the common Indian species of *Aedes* (Stegomyia) mosquitoes. J Commun Dis 1998; 30(2):123-8.
5. Delatte H, Paupy C, Dehecq JS, Thiria J, Failloux AB, Fontenille D. *Aedes albopictus*, vector of chikungunya and dengue viruses in Reunion Island: biology and control. Parasite. 2008; 15:3–13.
6. Evans AM. *Mosquitoes of the Ethiopian region*. II. Anophelini – adults and early stages. London: British Museum (Natural History) 1938. P. 368-79
7. Ferdousi F, Yoshimatsu S, Ma E, Sohel N, Wagatsuma Y. Identification of essential containers for *Aedes* larval breeding to control dengue in Dhaka, Bangladesh. Trop Med Hlth. 2015; 43(4):253-264.
8. Gubler DJ. Dengue and dengue hemorrhagic fever. *Clin Microbiol Rev*. 1998;11(3):480-496. doi:10.1128/CMR.11.3.480
9. Kolivras KN. Mosquito Habitat and Dengue Risk Potential in Hawaii: A Conceptual Framework and GIS Application. *Professional Geographer.* 2006;58((2)):139–154.DOI:10.1111. j.1467-9272.2006.00521.
10. Lindsay SW, Wilson A, Golding N, Scott TW, Takken W. Improving the built environment in urban areas to control *Aedes aegypti*-borne diseases. *Bull World Health Organ.* 2017;95((8)):607–608. doi: 10.2471/BLT.16.189688
11. Madzlan F, Doma NC, Tiong CS, Zakaria N. Breeding Characteristics of *Aedes* Mosquitoes in Dengue Risk Area. Procedia - SociBehav Sci. 2016; 234:164-172.
12. Muir DA. Anopheline mosquitoes: vector reproduction, lifecycle and biotype. In: Wernsdorfer WH, McGregor I, editors. Malarial principles and practice of malariology. London: Churchill Livingstone; 1988. P.431-51
13. Piyaratne MK, Amerasinghea FP, Amerasinghea PH, Konradsen F. Physico-chemical characteristics of *Anopheles culicifacies* and *Anopheles varuna* breeding water in a dry zone stream in Sri Lanka. *J Vector Borne Dis* 2005; 42: 62-7.
14. Sumodan PK. Potential of rubber plantations as breeding source for *Ae. albopictus* in Kerala, India. Dengue Bull. 2008; 27:197-8.
15. Tyagi BK, Dash AP. Dengue in India with special reference to the inter specific invasive and virus transmission potential of Asian tiger mosquito, *Aedesalbopictus* (Skuse) in Kerala: an update. *s*; 142-58
16. WHO, *Dengue Guidelines for Diagnosis, Treatment, Prevention and control, WHO, Geneva, Switzerland, 2009.*
17. Winchester J. *Aedes* mosquitoes in Hawaii. *Handle Proxy*. http://hdl.handle.net/10125/101582. Published August 1, 2011. Accessed July 18, 2018.