IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DISTRIBUTION AND LARVAL BREEDING HABITATS OF *Aedes aegypti* MOSQUITOES IN AND AROUND URBAN AREA OF BIKANER CITY.

Yogita Sharma, Ishwer Lal Jal , Nitesh Swami, Meera Srivastava, Kailash Kumar Swami
Laboratory of entomology, Department of Zoology, Govt. Dungar College Bikaner

Abstract

Dengue is the main serious vector borne disease on the earth with closely 2500 million human kinds at risk worldwide. Vector borne disease has today become a serious public health issue. This study's primary aim was to assess the diversity of breeding habitats for *Aedes aegypti* in the urban area of Bikaner city.

Adult *Aedes aegypti* mosquitoes were collected through using aspirators of various sizes from different breeding habitats, while larval stages were collected by dipping method and identified in a laboratory with the help of standard taxonomic keys.

A comprehensive examination of 310 containers was conducted, encompassing both outdoor and indoor locations within six distinct breeding habitats of urban areas of Bikaner city. It was observed that *Aedes aegypti* mosquitoes were predominantly associated with outdoor breeding sites compared to indoor ones. The most frequently identified breeding sites for *Aedes aegypti* included containers within households, discarded tyres, mud pots, jerricans, bird water pots, cattle water pots, plastic drums, pipe leakage and stagnant water.

These findings suggest that *Aedes aegypti* has adapted to survive in clean and clear water sources, such as tap water and rainwater with some organic matters.

Keywords: *Aedes* aegypti, breeding habitat, arboviral diseases, dengue.

Introduction:

Dengue is the main serious vector borne disease on the earth, with closely 2500 million human kinds at risk worldwide. Vector borne disease has today become a serious public health issue nearby 50-100 million cases described in completed 123 containers (1). *Aedes aegypti* mosquito is the primary vector of dengue. Dengue fever is a significant arboviral disease affecting humans health. The primary focus of this study was to investigate the diversity of breeding habitats for *Aedes aegypti* in the urban area of Bikaner city.

On a global scale, there are 950 known species of *Aedes*, with 115 of them reported in India. *Aedes albopictus*, with a similar distribution in Asia, also serves as a vector for diseases like Dengue and Chikungunya [2]. The distribution of *Aedes* mosquitoes are noted to be affected by environmental status.

Aedes aegypti, thought to have originated in Africa, likely spread to other continents through trade and transport ships that frequented African ports during the 15th to 17th centuries [3,4]. Currently, *Aedes aegypti* is widely distributed in Asia [5], with South-East Asia experiencing epidemic dengue outbreaks [6]. However, the current distribution does not fully encompass its potential historical range.

Urban areas with a high density of water storage containers are providing favourable condition to *Aedes* mosquito breeding [7]. These areas typically maintain a small number of *Aedes* breeding sites even during unfavourable months and consistently act as primary sources for *Aedes aegypti*, known as "Key Containers" [8], which can vary by region [9]. For instance, in the Philippines, key containers include plastic and metal drums as well as plastic containers [10], while in Australia; it is roof gutters [11]. In India, major breeding habitats for *Aedes aegypti* include cement tanks and plastic containers [12-13]. In the capital city, Delhi, overhead tanks and bird water pots have been identified as key containers for *Aedes* breeding [13).

The larva of *Aedes aegypti* was often reported in drum water reservoirs and polyethene sheets. Further different breeding sites can be reported in buckets and blank paint cans in semi urban areas wherever *Aedes albopictus* larvae were reported mainly in another container and closed in fully areas (14).

Fig 1:- Area map of Bikaner

Methodology:

The geographical coordinates of Bikaner, Rajasthan, India, are 28.027138° latitude and 73.302155° longitude. It falls within the Cities category of India, marked by GPS coordinates of 29° 1'37.6968" N and 73° 18' 7.7580" E. Our research encompassed periodic investigations conducted from Jan 2022 to Dec 2022. Mosquitoes and their larval stages were collected through the use of suction tubes and torches, as well as the dipping method for larval stages. In the laboratory, these specimens were carefully reared and identified using established standard taxonomic keys provided by Roy & Brown (2003) [15].

To collect mosquito larvae, we employed various techniques, such as using a plastic cup, pipette, or traditional dipper. When approaching larger containers like discarded tyres, we took care to minimize disturbance by swiftly immersing the cup at the water's surface instead of scooping water slowly. For smaller containers, we transferred the water to pans to facilitate the collection of immature stages. In cases where the openings of tyres and containers were too narrow, we utilized a pipette to extract the water.

Results:

A result of 310 mosquitoes containers from indoor and outdoor were collected in the urban environment of Bikaner district. *Aedes aegypti* mosquitoes were found mainly in outdoor breeding sites as compared to indoor ones. It was observed that the most prevalent breeding sites for *Aedes aegypti* included household containers, tyres, mud pots, bird water pots, cattle water pots, plastic drums, pipe leakages, and stagnant water, among others (Table 2).

During investigation it is observed that in urban area of Bikaner city, the preferred location which provide most flourish environment to *Aedes aegypti* displayed a higher preference for the Ranisar bas area (5.17) followed by Nagar nigam (4.85) and Veterinary college campus (4.68) (Table. 1)

The preferred breeding habitats of *Aedes aegypti* was Cattles water point (63.00) followed by Bird water points (61.00) House hold (31.00), Stagnant water (28.0) Tyres (26.0) (Table 2).

Table 1: Month wise density (No. per man hour) of mosquito *Aedes aegypti* in Bikaner city (Jan 2022 to Dec 2022) values are monthly average data of one year

Month	Ranisar Bas	Pareek Chowk	Veterinary College campus	Nagar Nigam Area	Agriculture College campus	Nagnechi temple
January	00	00	00	1.00	00	00
February	00	00	00	2.25	00	00
March	1.25	00	1.25	4.00	00	3.25
April	3.15	1.50	00	3.75	00	2.15
May	1.15	00	00	3.15	2.00	00
June	2.25	3.25	3.00	3.00	3.10	6.75
July	6.75	4.50	7.00	7.00	4.20	4.50
August	16.50	11.75	10.50	12.15	6.00	6.60
September	18.75	16.25	4.25	10.25	2.00	4.00
October	12.25	15.50	2.10	2.01	00	3.00
November	00	3.00	00	00	00	00
December	00	00	00	00	00	00

Table 2: Occurrence and abundance mosquito *Aedes aegypti* in Bikaner city
(Values are monthly average of one year data) (Jan 2022 to Dec 2022)

Month	Plastic drum	Mud pot	Tyres	House hold	Bird water point	Stagnant water	Cattles water point	Pipe leakage
January	–	–	–	–	–	–	–	–
February	–	–	1	–	1	–	–	–
March	–	3	4	2	3	–	2	–
April	–	3	5	2	5	3	4	–
May	–	2	–	4	5	3	3	2
June	3	–	3	5	6	2	6	2
July	2	5	5	4	10	4	8	4
August	5	3	4	3	12	4	14	7
September	4	5	3	4	10	5	10	5
October	7	2	1	6	6	5	6	4
November	-	–	–	–	2	2	5	-
December	-	–	–	1	1	–	5	–
Total	21	23	26	31	61	28	63	24

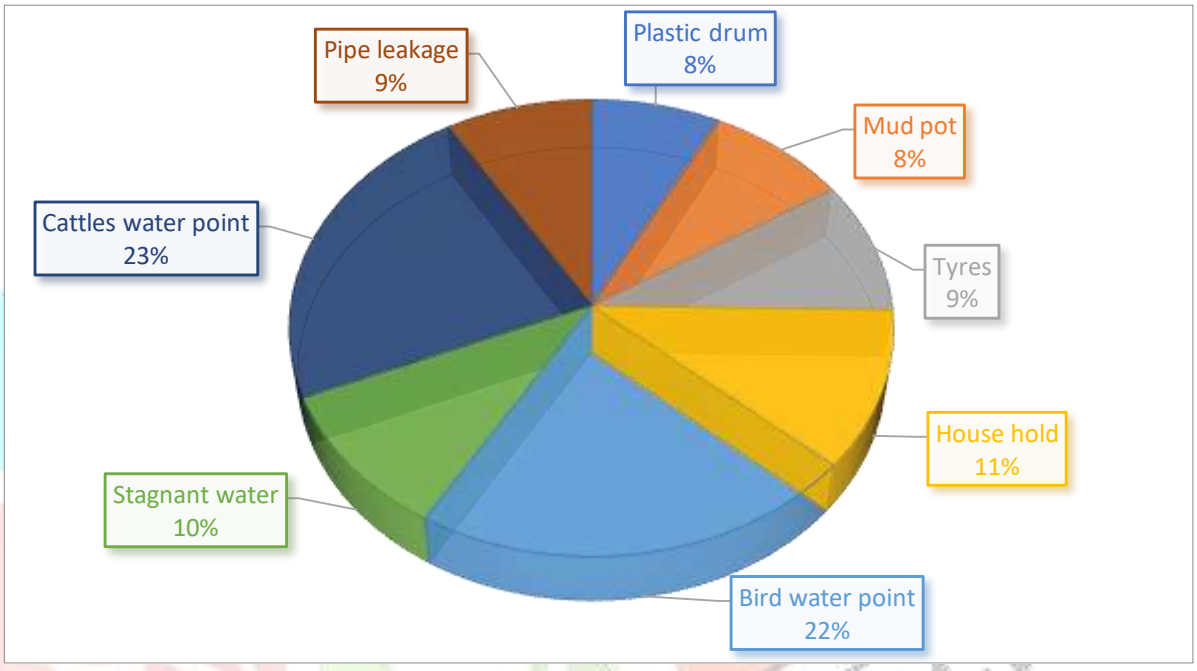

Fig. 2:- Occurrence and abundance (No. per man hour) of mosquito *Aedes aegypti* in Bikaner city
(Values are monthly average of one year data) (Jan 2022 to Dec 2022)

Discussion:

The water chemistry of aquatic habitats is likely a crucial factor influencing the survival of mosquitoes [17, 19]. *Aedes aegypti* demonstrates a high degree of specialization in its choice of breeding sites, which, in turn, constrains the species distribution [20]. Given that the presence of water in containers is a paramount factor in mosquito breeding, particularly for *Aedes* and *Culex* species, it is imperative to establish a mosquito control program in Bikaner city. To control mosquitoes breeding in containers, a combination of methods can be employed, including covering water-holding containers [16, 34], utilizing suitable biological control agents [16], public health education initiatives [14, 15, 21], increasing resident knowledge and awareness of mosquito-borne diseases [21], removing unused containers filled with water [14, 15], weekly container drainage [18], and implementing effective waste management systems for residential areas [15]. However, a more targeted approach that focuses on specific types of water-holding containers may prove more efficient for vector control than attempting to eliminate all such containers [22].

Conclusion:

These findings indicate that *Aedes aegypti* has adapted to breed in clean and clear water, such as tap or rainwater with some organic matters. It's worth noting that this study solely involved the collection and identification of mosquito larvae from tyres, household containers, and discarded water-holding items. Further investigations should explore the presence of mosquito larvae in natural water-holding containers and larger water tanks. Additionally, viral isolation by collecting adult female mosquitoes should be undertaken to determine if they carry the dengue disease pathogen. Furthermore, efforts to raise awareness among the population about preventive measures against the disease should be intensified, particularly in the event of a potential epidemic.

References:-

1. Brady OJ, Gething PW, Bhatt S, Messina JP, Brownstein JS, Hoen AG et al. Refining the global spatial limits of dengue virus transmission by evidence based consensus. *PLoS Neglected Tropical Disease*. 2012; 6:e1760
2. Soper FL, 1667. Dynamics of *Aedes agypti* Distribution and Density. Bull. Wld. Hlth. Org. 36:536 – 5538.
3. Saifur RG, Hassan AA, Dieng H, Salman MRC, Saad AR, Satho T. Temporal and spatial distribution of dengue vector mosquitoes and their habitat pattern in Penang Island ,Malasiya. *Journal of the American Mosquitoes Control Association* . 2013;29(1):33-43.
4. Christophers SR. *Aedes aegypti* (L.) the Yellow Fever Mosquito; Cambridge University Press: London, UK, 1960.
5. Reiter P, *Aedes albopictus* and the world trade in used tyres, 1988e1995: the shape of things to come? *Journal of American Mosquito Control Assoc*. 1998;14(1998)
6. Halstead SB. Dengue in the Americas and Southeast Asia: do they differ? Rev. Panam. Salud. Publication. 2006; 20(2006)
7. Kamimura K, Matsuse IT, Takahashi H,Komukai J, Fukuda T, Suzuki K et al. Effect of temperature on the development of *Aedes aegypti* and *Aedes Albopictus*. *Medical Entomology*. *Zoology*. 2002; 53 (2002)
8. Sinh Vu N.Key container and key premise indices for *Ae. aegypti* surveillance and control. In: Linda S. Lloyd editor. Best practices for dengue prevention and control in the Americas. Strategic Report;2013; pp.51-56.
9. Salamat MSS, Cochon KL, Crisostomo GCC, Gonzaga PBS, Quijano NA, Torio JF, *et al*. Entomological Survey of Artificial Container Breeding Sites of Dengue Vectors in Batasan Hills, Quezon City. *Acta Medica Philippina*. 2013; 47(3): 63–68.
10. Edillo FE, Roble ND, Otero ND 2nd. The key breeding sites by pupal survey for dengue mosquito vectors, *Aedes aegypti* (Linnaeus) and *Aedes albopictus* (Skuse), in Guba, Cebu City, Philippines. South- east Asian *Trop J Med. Public Health*. 2012; 43(6): 1365–1374.
11. Montgomery BL, Ritchie SA. Roof gutters: a key container for *Aedes aegypti* and Ochlerotatus notoscriptus (Diptera: Culicidae) in Australia. *American Journal of Tropical Medicine and Hygiene*. 2002; 67(3): 244–246.
12. Balakrishnan N, Venkatesh S, Lal S. An entomology study on the dengue vector during outbreak of dengue in Tirupur town and its surroundings, Tamil Nadu, India. *J Commun Dis*. 2006; 38:164–168.
13. Mondal R, Devi NP, Jauhari RK. Occurrence of *Aedes* mosquitoes (DIPTERA: CULICIDAE) in urban areas of doon valley, (Uttarakhand), INDIA. *Modern Parasitology*. 2014; 28:255–262.
14. Vikram Kumar, Nagpal BN, Pande Veena, Aruna Srivastava, Gupta Sanjeev K,Anushrita, *et al*. Comparison of *Ae. aegypti* breeding in localities of different socio-economic groups of Delhi,India. *International Journal of Mosquito Research* 2015; 2(2): 83–88.
15. Roy DN, Brown AWA. Entomology. Biotech Books, New Delhi. 2003, 1-413.
16. M. A. Bhat and K. Krishnamoorthy, "Entomological investigation and distribution of *Aedes* mosquitoes in Tirunelveli, Tamil Nadu, India," *International Journal of Current Microbiology Application Sciences*, vol. 3, no. 10, pp. 253–260, 2014.
17. S. N. R. Saleeza, Y. Norma-Rashid, and M. Sofian-Azirun, "Mosquitoes larval breeding habitat in urban and suburban areas, Peninsular Malaysia," *International Journal of Biological Veterinary, Agricultural and Food Engineering*, vol. 5, no. 10, pp. 81–85, 2011.
18. Philbert and J. N. Ijumba, "Preferred breeding habitats of *Aedes aegypti* (Diptera-Culicidae) mosquito and its public health implications in Dares Salaam, Tanzani," *Journal of Environmental Research and Management*, vol. 4, no. 10, pp. 344–351, 2013
19. D. Chen, H. L. Lee, S. P. Stella-Wong, K. W. Lau, and M. Sofian-Azirun, "Container survey of mosquito breeding sites in a university campus in Kuala Lumpur, Malaysia," *Dengue Bulletin*, vol. 33, no. 1, pp. 187–

193, 2009.
20. Hiscox, A. Kaye, K. Vongphaylothe*t al*., "Risk factors for the presence of *Aedes aegypti* and *Aedes albopictus* in domestic water-holding containers in areas impacted by the Nam Theun 2 hydroelectric project, Laos," *American Journal of Tropical Medicine and Hygiene*, vol. 88, no. 6, pp. 1070–1078, 2013.
21. K. Rajesh, D. Dhanasekaran, and B. K. Tyagi, "Survey of container breeding mosquito larvae (Dengue vector) in Tiruchirappalli district, Tamil Nadu, India," *Journal of Entomology and Zoological Studies*, vol. 1, no. 6, pp. 88–91, 2013.
22. P. Thangamathi, S. Ananth, and N. Kala, "Seasonal variations and physicochemical characteristics of the habitats in relation to the density of dengue vector *Aedes aegypti* in Thanjavur, Tamil Nadu, India," *Journal of Tropical Biodiversity and Biotechnology 2020* vol. 5, pp. 271–276, 2014
23. K. D. Thete and L. V. Shinde, "Survey of container breeding mosquito larvae in Jalna City (M.S.), India," *Biological Forum*, vol. 5, no. 1, pp. 124–128, 2013.
24. T. Chareonviriyaphap, P. Akratanakul, S. Nettanomsak, and S. Huntamai, "Larval habitats and distribution patterns of *Aedes aegypti* (Linnaeus) and *Aedes albopictus* (Skuse), in Thailand," Southeast *Asian Journal* of *Tropical Medicine* and *Public* Health, vol. 34, no. 3, pp. 529–535, 2003
25. Kyle JL, Harris E. Global spread and persistence of dengue. *Annu Rev Microbiol* 2008; 62:71–92.