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# Ovitrap Surveillance of *Aedes* Mosquitoes (Diptera: Culicidae) in Selected Areas of Dehradun District, Uttarakhand, India

N. Pemola Devi<sup>α</sup>, R.K. Jauhari<sup>ο</sup> & Ritwik Mondal<sup>ο</sup>

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**Methods:** Ovitrap were placed at three sites *viz.*, Sahastradhara, Garhi Cantt. and Karanpur of Dehradun city during August 2012 - July 2013 and examined weekly. Collected paddles were submerged into a bowl of water containing larval food. The hatched larvae were subsequently counted and reared in the cages to emerge into adults and identified upto species level using respective Keys and Catalogues. The estimation of ovitrap indices was done following the protocol developed by FEHD. and Lim et al.(2010)

**Result:** As many as 6 species of *Aedes viz.*, *Aedes aegypti*, *Ae. albopictus*, *Ae. edwardsi*, *Ae. pseudotaeniatus*, *Ae. unilineatus* and *Ae. vittatus* were collected during the study period. *Ae. aegypti* shared highest (37.28%) followed by *Ae. albopictus* (33.27%), *Ae. pseudotaeniatus*, (15.68%) and *Ae. vittatus* (8.33%). The mixed breeding comprised larvae of *Culex*, *Anopheles* and some unidentified species and shared least percentage (3.10%). In indoor, overall mosquito accounts low percentage (18.82%) in all three localities as compared to outdoor percentage (19.47%). Maximum ovitrap index was encountered from Garhi Cantt. (48.75) followed by Karanpur (45.00) and Sahastradhara (43.75) during August 2012. Outdoor indices of area ovitraps index were in the range of 17.30±1.83 to 21.88±2.10, while in indoors the range was 12.30±1.67 to 15.42±1.56. Monthly ovitrap index of the study period ranged from 0.00 to 45.83.

**Conclusion:** Ovitrap provide a very sensitive and economical method for detecting container breeders when the population density is low. A high density of dengue vectors in the residential area warrants the vector surveillance activities in time along with awareness programme.

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## I. INTRODUCTION

Dengue, a major public health problem in India is an arbo-viral disease caused by the dengue virus (DENV) (Family: *Flaviviridae*) comprising four serotypes (DEN-1, DEN-2, DEN-3 and DEN-4) and female *Aedes* mosquito, mainly *Ae. aegypti* and *Ae. albopictus* play a role in the transmission of disease. Dengue Virus Infection (DVI) cause a spectrum of disease ranging from mild infection (dengue fever, DF) to a severe deadly disease - dengue haemorrhagic fever/dengue shock syndrome (DHF/DSS) [1]. About 40% of the global population is living in the areas where transmission of dengue occurs. In an estimate, 50 million dengue infections, including 5,00,000 cases of DHF require hospitalization every year [2]. Earlier, estimated 3.46-3.61 billion people live in areas at risk of dengue from 124 countries which correspond to 53.0-55.0% of the world population [3]. Due to global warming *Ae. aegypti* and *Ae. albopictus* moved northward and had more rapid metamorphosis, the WHO expects millions more to be affected in the coming years [4].

In district Dehradun, the Dengue infections are well established from the year 2006 onwards. The abundance of vectors species have been reported by earlier works [5,6] who observed the breeding of *Ae. aegypti* in both natural habitats and domestic containers. Larval population of *Ae. aegypti* has been recorded in drains, pits, streams, canals, containers and tree holes while the breeding of *Ae. albopictus* was recorded in tanks, ponds, streams, containers and tree holes from district Dehradun [7]. The occurrence of *Ae. vittatus* in Garhwal region in Uttarakhand state was recorded in the past [8,9] and in recent years too [10]. Moreover, from Nainital district in Kumaon region of Uttarakhand, entomological investigations during an outbreak of Dengue fever in Lal Kuan town revealed larval and adult stages of *Ae. aegypti* and *Ae. albopictus* in transmission season [11].

*Ae. aegypti* is an urban mosquito that breed almost entirely in man-made containers (cistern, flower pots, tanks, tyres and cans) found in and around

households, construction sites, factories etc. On the contrary, *Ae. albopictus* breeds in both man-made containers as well as in natural containers such as bamboo, tree holes and leaf axils. Ovitrap surveillance is the most common sampling method to monitor *Ae. aegypti* and *Ae. albopictus* populations through their egg laying activities [12]. It has been claimed to be a more effective and sensitive technique as compared to the conventional larval surveys, especially when the *Aedes* infestation rates were very low [13].

Keeping in view that for the last 3-4 years, on one hand there is an increase in Dengue cases in Dehradun (India) while on the other hand, lack of information in bionomics of *Aedes* sp. involved in Dengue transmission, it was decided to determine the

efficacy of ovitraps in monitoring the distribution and abundance of *Aedes* species in different urban and suburban areas of district Dehradun in Uttarakhand state, located in the northern India.

## II. METHODS

### a) Study Area

The present study was carried out mainly in urban area of Doon Valley (latitude 30° 19'N, 78° 04'E, longitude 77°35'E to 78°20'E) in district Dehradun (Uttarakhand). Ovitrap surveillance was conducted at three sites of Dehradun city: Sahastradhara, Garhi Cantt. and Karanpur from August 2012 - July 2013. The ecological description of the study sites is being provided as under –

*Table 1* : Ecological description of the study site

Study site	Ecological description
<b>Sahastradhara</b>	Abundant natural vegetation like trees and shrubs, clean environment and mainly two-storied newly made buildings.
<b>Garhi Cantt.</b>	Lush green vegetation, environment is clean and in general newly made buildings exist.
<b>Karanpur</b>	Less vegetation, environment partly clean and highly populated and both old and new buildings are common.

### b) Ovitrap surveillance

Each ovitrap was placed indoor and outdoor in randomly selected houses scattered over the study area. The paddles were collected individually from the ovitraps on weekly basis. Thereafter, fresh paddles were put in the ovitraps jar and the water level was adjusted so that they would remain moist. Collected paddles were submerged into a bowl of water containing larval food. The hatched larvae were subsequently counted and reared in the cages to emerge into adults. The adults were identified upto species level using respective Keys and Catalogues [14,15,16]. The estimation of ovitrap indices was done following the protocols developed [17,18]. The following indices were work out:-

- i. *Ovitrap Index (OI)*: The percentage of *Aedes* positive trap.
- ii. *Area Ovitrap Index (AOI)*: Calculating the extensiveness of the distribution of the *Aedes* mosquitoes in a particular area.
- iii. *Monthly Ovitrap Index (MOI)*: Monthwise *Aedes* positive trap (average of all AOIs).

## III. RESULTS

During the study period, 20 ovitraps (10 indoors and 10 outdoors) were installed for each week in each locality and observed the ovitrap index on monthly basis (Table 2). Maximum index was encountered from Garhi

Cantt (48.75) followed by Karanpur (45.00) and Sahastradhara (43.75) during the month of August. During January and February, the breeding index was found nil. In all selected localities, the ovitrap indices were high during June to September. The mean indices were 18.65, 15.63 and 15.94 at Sahastradhara, Garhi Cantt and Karanpur respectively.

Fig.1 shows the Area Ovitrap Index (AOI) of the selected sites during the study period. The outdoor indices were in the range of 17.30±1.83 - 21.88±2.10. Highest index was found at Sahastradhara (21.88±2.10) followed by Karanpur (19.58±1.94) and Garhi Cantt (17.30±1.83). All the indoor ovitraps showed low index in all three localities in comparison to outdoor ovitraps (12.30±1.67- 15.42±1.56).

Fig. 2 shows the MOI of the study period ranging from 0.00 to 45.83. Highest MOI was found during August (45.83) followed by July (36.66) and September (30.41). During the winter months like January and February, the index was recorded nil.

Fig. 3 shows the composition of *Aedes* mosquitoes in ovitraps at selected sites. A total of 6 *Aedes* species viz., *Aedes aegypti*, *Ae. albopictus*, *Ae. edwardsi*, *Ae. pseudotaeniatus*, *Ae. unilineatus* and *Ae. vitattus*. were collected. Of these, *Ae. aegypti* shared highest (37.28%) followed by *Ae. albopictus* (33.27%), *Ae. pseudotaeniatus*, (15.68%) and *Ae. vitattus* (8.33%). The mixed breeding comprising larvae of *Culex*, *Anopheles* and some unidentified species shared 3.10%

only. In indoor, overall mosquito accounts low percentage (48.2%) in all three localities as compared to outdoor percentage (51.8%).

#### IV. DISCUSSION & CONCLUSION

Owing to inherent human behaviour and some traditional habits, detection of the presence of different mosquito vectors in urban situations has been a difficult task. It has been observed that the vector species are common in most areas on account of deficient water management, presence of non degradable and long-lasting water holding containers and materials, as well as increasing urban agglomerations and inability or lack of mobilization to the population to the need to eliminate mosquito breeding sites. In a study conducted on dengue vector surveillance at Malaysia, the mosquito abundance was found related to population and human activity [19]. Occurrence of positive ovitraps in sampled houses positive ovitraps is an indication of human activity that provides a suitable environment for the propagation of these vector species in the residential area.

Earlier, it was stated that *Ae. aegypti* is strictly domiciliary, preferring less vegetation, biting indoors and primarily found indoors, while *Ae. albopictus* is found outdoors and breeds in all types of natural containers [20,21]. In these aspects, there is a bit similarity with the results of our study.

Dengue is a disease associated with the slum areas, where breeding of *Aedes* mosquitoes is most prevalent [22]. However, the ovitrap surveillance in the selected areas showed that *Aedes* mosquitoes are not only associated with the slum areas, but they are also associated with the residential area. As per the gathered observations, the settlement site had numerous natural and artificial containers providing good larval habitats. But the residential sites had a clean environment, with minimal natural containers. As all the houses had piped water supply, thus there was no necessity for the residents to store water. From our observations, the residential sites had minimal natural containers. The only possible habitat for *Aedes* mosquitoes was the concrete drainage system outside the houses. The drains had clear stagnant water with fallen leaves and other debris. *Aedes* larvae require clear, but not necessarily clean water and this was provided by the clear stagnant clear water of the drain [23,24]. In this way the drains served as good artificial larval containers for *Ae. aegypti*.

In the past, it was found out that *Ae. aegypti* rests in secluded locations inside homes such as under beds, in closets and on curtains [25]. In contrast, *Ae. albopictus* which breeds in both man-made containers such as cans, tires and water jars; as well as natural containers such as bamboo, bromeliads and coconut shells is more cosmopolitan in its feeding habitats and

rests both inside and outside homes, making control difficult.

*Aedes* population has been observed in the ovitraps in both indoor and outdoor placement in urban residential sites, through the positivity of ovitraps was more in outdoor than indoor [26], thus resembling with our studies. Further, similar results were obtained in a study on surveillance of *Aedes* mosquitoes in a University Camps in Kuala Lumpur [27]. This may be due to availability of natural potential breeding sites such as bamboo tree, tree holes and mudden broken containers in outdoor environment.

Conclusively, the prevalence of a high density of dengue vectors in an urban area inspires an intensification of the vector surveillance activities jointly with community participation.

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#### REFERENCES RÉFÉRENCES REFERENCIAS

1. World Health Organization. Dengue haemorrhagic fever: diagnosis, treatment, prevention and control. 2nd ed. Geneva: WHO, 1997.
2. Guidelines for dengue surveillance and mosquito control, II edn. Manila, Philippines: WHO Regional Office of the Western Pacific 2003; 105.
3. Beatty MR, Letson W, Edgil DM, Margolis HS. Estimating the total world population at risk for locally acquired dengue infection. 50th ASTMH Meeting 2007.
4. TIME. (2007). Vagobond Virus. Dengue fever is spreading and some think climate change is to blame. TIME magazine 2007.
5. Jauhari RK, Singh RP, Singh S. Breeding and resting site of mosquitoes in the forested areas of Doon Valley. Indian Journal of Forestry. 1995; 18(3): 249-250.
6. Mahesh RK, Singh RP, Singh S, Jauhari RK. Breeding of mosquitoes in the urban areas of city Dehradun. Uttar Pradesh Journal of Zoology. 1995; 15(2):100-102.
7. Mahesh RK, Jauhari RK. Mosquito fauna of the forested areas of Doon valley, (UP) India. Entomon. 2003; 28(2): 185-190.
8. Rao TR, Dhanda V, Bhat HR, Kulkarni SM. A survey of haematophagous arthropods in western Himalayas, Sikkim and hill districts of West Bengal: a general account. Indian Journal of Medical Research. 1973; 61(10): 1421-1461.
9. Bhatt HR. A survey of haematophagous arthropods in western Himalayas, Sikkim and hill districts of



- West Bengal: records of mosquitoes collected from Himalayan Region of Uttar Pradesh with ecological notes. Indian Journal of Medical Research. 1975; 63(11): 1583-608.
10. Pemola Devi N, Jauhari RK. Mosquito records from Garhwal region (Uttaranchal). Journal of Experimental Zoology, India. 2004; 7(2):237-244.
  11. 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 Disease. 2010; 47:189-192.
  12. Service MW. Importance of ecology in *Aedes aegypti* control. Southeast Asian Journal of Tropical Medicine and Public Health. 1992; 23:681-688.
  13. Lee HL. Sequential sampling: its application in ovitrap surveillance of *Aedes* (Diptera: Culicidae) in Selangor, Malaysia. Tropical Biomedicine. 1992; 9: 29-34.
  14. Das BP, Kaul SM. Pictorial key to the common Indian species of *Aedes* (*Stegomyia*) mosquitoes. Journal of Communicable Disease. 1998; 30(2): 123-128.
  15. Rueda LM. Pictorial keys for the identification of mosquitoes (Diptera: Culicidae) associated with dengue virus transmission. Zootaxa. 2004; 589: 1-60.
  16. Barruad PJ. The fauna of British India, Diptera Vol - V. Today and tomorrow's Printers and Publishers. 1934; 136-143.
  17. Department of Food and Environmental Hygiene, Government of Hong Kong Special Administrative region. China Mosquitoes of Hong Kong. Mosquitoes of Hong Kong, 2005.
  18. Lim KW, Sit NW, Norzahina R, Sing KW, Wong HM, Chew HS, Firdaus R, Cheryl JA, Suria M, Mahatavan M, et al. Dengue vector surveillance in insular settlements of Pulau Ketam, Selangor, Malaysia. Tropical Biomedicine. 2010; 27(2):185-192.
  19. Okogun GRA, Nwoke BEB, Okera AN, Anosike JC, Esekhegbe AC. Epidemiological implications of the preferences of breeding sites of mosquito species in Midwestern Nigeria. Annals of Agricultural and Environmental Medicine, 2003; 10:217-22.
  20. Sucharit S, Tumrasvin W, Vutikes S, Viraboonchai S. Interactions between larvae of *Ae. aegypti* and *Ae. albopictus* in the mixed experimental populations. Southeast Asian Journal of Tropical Medicine and Public Health. 1978; 9:93-97.
  21. Foo L, Lim TW, Lee, HL, Fang R. Rainfall, abundance of *Aedes aegypti* and dengue infection in Selangor, Malaysia. Southeast Asian Journal of Tropical Medicine and Public Health. 1985; 16(4):560-568.
  22. Chan KL, Counsilman JJ. Effects of slum clearance, urban redevelopment and vector control on densities of *Aedes* mosquitoes in Singapore. Tropical Biomedicine. 1985; 2:139-147.
  23. Lee HL, Hishamudin M. Nationwide *Aedes* larval survey in the urban towns of peninsular Malaysia (1988-89). Tropical Biomedicine. 1990; 7:185-188.
  24. Lee HL. A nationwide resurvey of the factors affecting the breeding of *Aedes aegypti* (L.) and *Aedes albopictus* (Skuse) (Diptera: Culicidae) in urban town of peninsular Malaysia-1988-1989. Tropical Biomedicine. 1991; 8:157-160.
  25. Perich MJ, Davila G, Turner A, Garcia A, Nelson M. Behaviour of resting *Aedes aegypti* (Culicidae: Diptera) and its relationship to ultra-low volume adulticide efficacy in Panama City, Panama. Journal of Medical Entomon. 2000; 37:541-546.
  26. Dhang CC, Benjamin S, Saranum MM, Fook CY, Lim LH, Ahmad NW, Azirun, M.S. Dengue vector surveillance in urban residential and settlement areas in Selangor, Malaysia. Tropical Biomedicine. 2005; 22(1):39-43.
  27. Wan-Norafikah O, Chen CD, Soh HN, Lee HL, Nazni WA, Sofian-Azirun M. Surveillance of *Aedes* mosquitoes in the university campus in Kuala Lumpur, Malaysia. Tropical Biomedicine. 2009; 26(2):206-215.

**Table 2 :** Month-wise statement about ovitraps installed at selected localities in district Dehradun during Aug 2012- July 2013.

Months	Sahastradhara		Garhi Cantt.		Karanpur	
	Ovitraps		Ovitraps		Ovitraps	
	Installed	Positive index	Installed	Positive index	Installed	Positive index
<b>Aug. 12</b>	20/ turn	43.75	20/ turn	48.75	20/ turn	45.00
<b>Sept. 12</b>	20/ turn	27.50	20/ turn	33.75	20/ turn	30.00
<b>Oct. 12</b>	20/ turn	26.25	20/ turn	16.25	20/ turn	23.75
<b>Nov. 12</b>	20/ turn	16.25	20/ turn	7.50	20/ turn	5.00
<b>Dec. 12</b>	20/ turn	1.25	20/ turn	2.50	20/ turn	1.25
<b>Jan. 13</b>	20/ turn	0.00	20/ turn	0.00	20/ turn	0.00
<b>Feb. 13</b>	20/ turn	0.00	20/ turn	0.00	20/ turn	0.00
<b>Mar. 13</b>	20/ turn	1.25	20/ turn	1.25	20/ turn	1.25
<b>Apr. 13</b>	20/ turn	16.25	20/ turn	10.00	20/ turn	8.75
<b>May 13</b>	20/ turn	21.25	20/ turn	16.25	20/ turn	17.50
<b>Jun. 13</b>	20/ turn	27.50	20/ turn	20.00	20/ turn	21.25
<b>July 13</b>	20/ turn	42.50	20/ turn	31.25	20/ turn	36.25

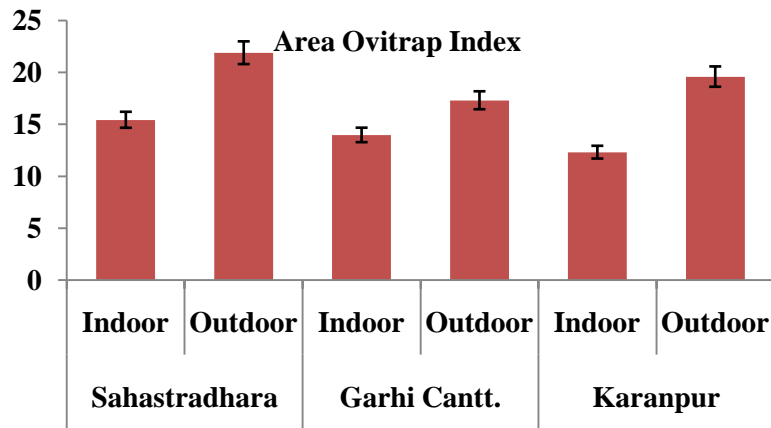


Figure 1 : Showing Area Ovitrap Index (AOI) at three localities in district Dehradun.

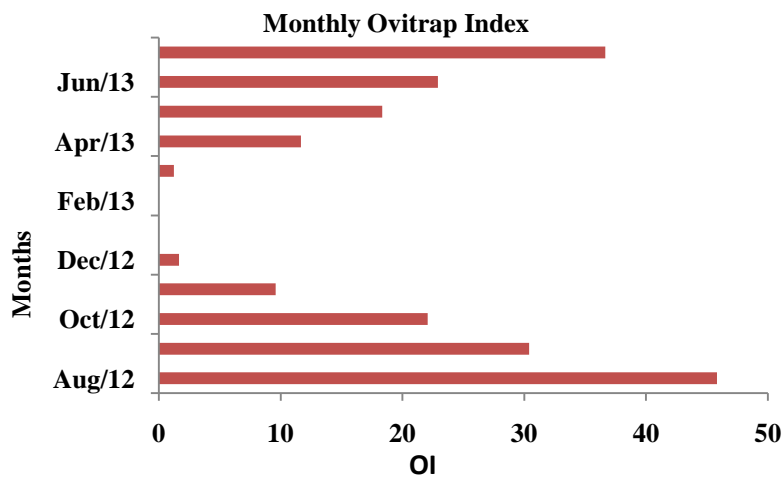


Figure 2 : Showing Monthly Ovitrap Index (MOI) at selected localities in district Dehradun during Aug 2012- July 2013.

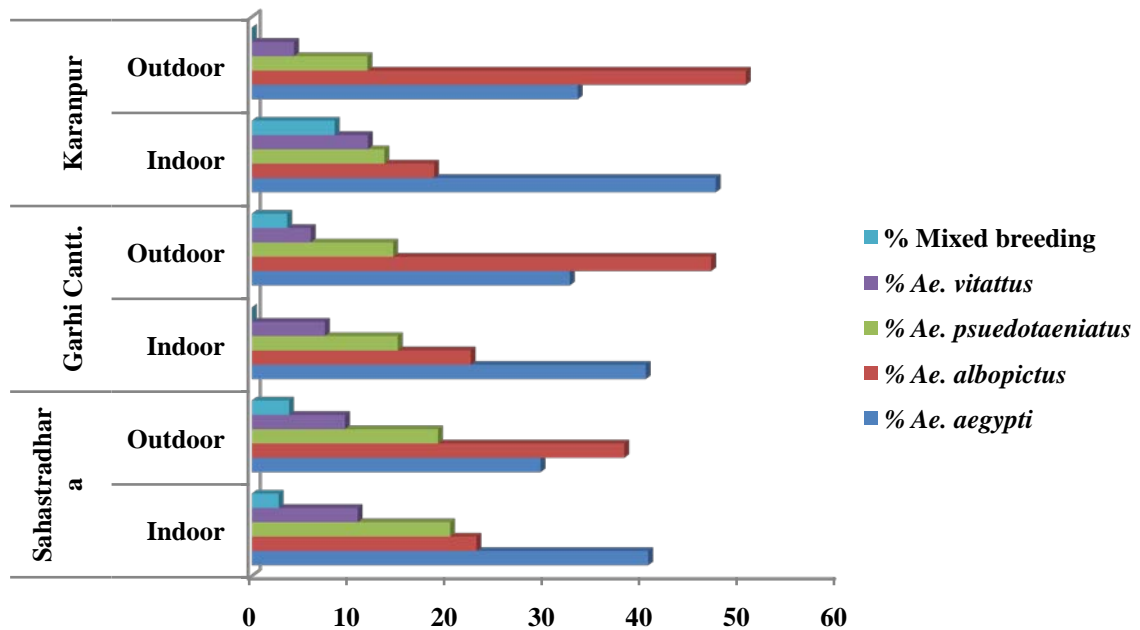


Figure 3 : Composition of Aedes population in ovitraps at selected localities in district Dehradun during Aug 2012- July 2013.