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Predominance of *Aedes albopictus* in the breeding habitats of Siliguri Sub-division of Darjeeling District, West Bengal, India

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ABSTRACT: To determine the predominant dengue mosquito vector from the Siliguri sub-division of Darjeeling district, a field survey conducted and results showed that *Ae. albopictus* (804 out of 886) was relatively more abundant than *Ae. aegypti* (2 out of 886) in natural and artificial containers. The results from the installed ovitraps also indicated *Ae. albopictus* (1434 out of 1490) as dominant species in the artificial containers than primary vector *Ae. aegypti* (2 out of 1490) in the shared breeding habitats. Larval density of *Ae. albopictus* was remarkably higher than that of *Ae. aegypti* in both the natural-artificial containers and ovitraps. © 2024 Association for Advancement of Entomology

KEY WORDS: Dengue vectors, natural and artificial habitats, ovitraps, abundance, larval density

Darjeeling is one among the three dengue endemic districts of northern West Bengal and listed as 'high-risk' category in the reports of State Vector Borne Diseases Control and Seasonal Influenza Plan (SVBDCSIP, 2018). Siliguri sub-division alone reports about thousands of dengue cases each year. *Aedes aegypti* Linnaeus and *Aedes albopictus* Skuse are the two principal vectors of dengue over the dengue epidemic regions of the world (de Almeida *et al*., 2021). Both, *Ae. aegypti* and *Ae. albopictus* were reported from that area and largely confined to that region (Saha and Saha, 2021). The female *Ae. aegypti* are diurnal biters, mate near the blood-meal host and oviposit exclusively in fresh water (Captain-Esoah, 2020). *Ae. albopictus* mainly occurs in rural and sub-urban regions where they readily oviposit in the natural containers like-tree holes, rotten tree stumps, bamboo stumps but in urban environment they have occupied almost all kinds of artificial containers, especially cemented tanks, different types of plastic containers, glass, metal or earthen pots and even shallow water pools. As breeding habitat for *Ae. aegypti* and *Ae. albopictus* are almost identical, the distribution of both *Aedes* species overlap in many regions (Mbanzulu *et al*., 2022). The present study has been conducted with the aim to report which vector species of *Aedes* genus are most abundant and predominantly occupied the breeding habitats in the surveyed area. Clear understanding about the dengue-mosquito vector will help to know its habitat ecology, design effective vector control measures and dengue prevention.

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The study was conducted over Siliguri sub-division area of Darjeeling district of West Bengal, India, which area falls under the southern foot-plain zone of Darjeeling Himalaya. The area shares international borders with neighbouring nations namely -Bangladesh in south-east and Nepal in west. The sub-division has four blocks, namely - Matigara, Naxalbari, Khoribari and Phansidewa. Larval sampling and installation of ovitraps were done in two sites in each block of the sub-division

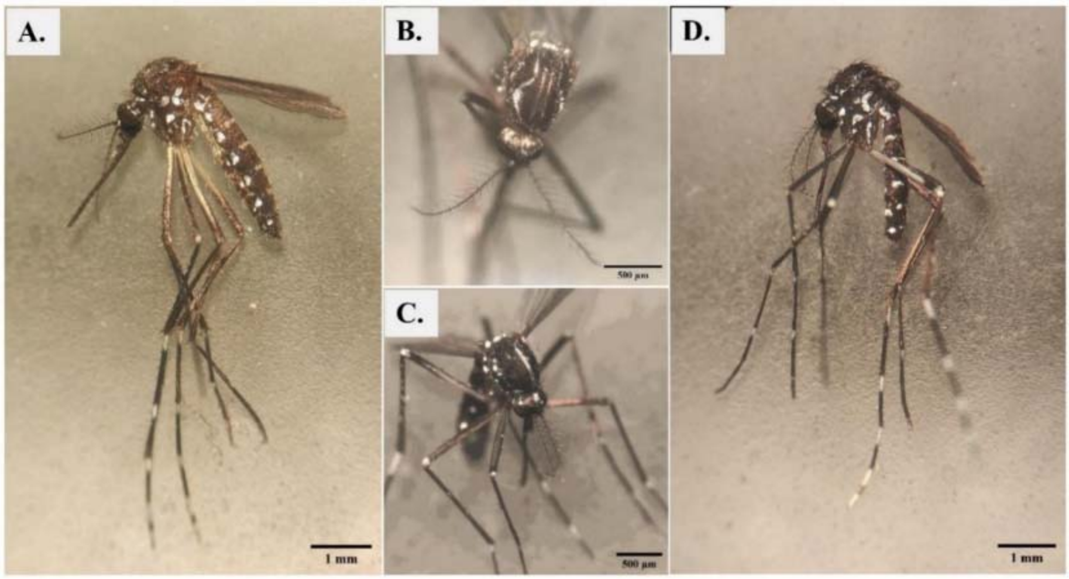

Fig. 1 Image of *Ae. aegypti* (A and B). A. Mesepimeron having two well separated white scale patches; B. Scutum having a pair of sub-median longitudinal lyre-shaped markings; Image of *Ae. albopictus* (C and D). C. Scutum black, having a narrow median longitudinal white stripe; D. Mesepimeron have un-separated V-shaped white patches

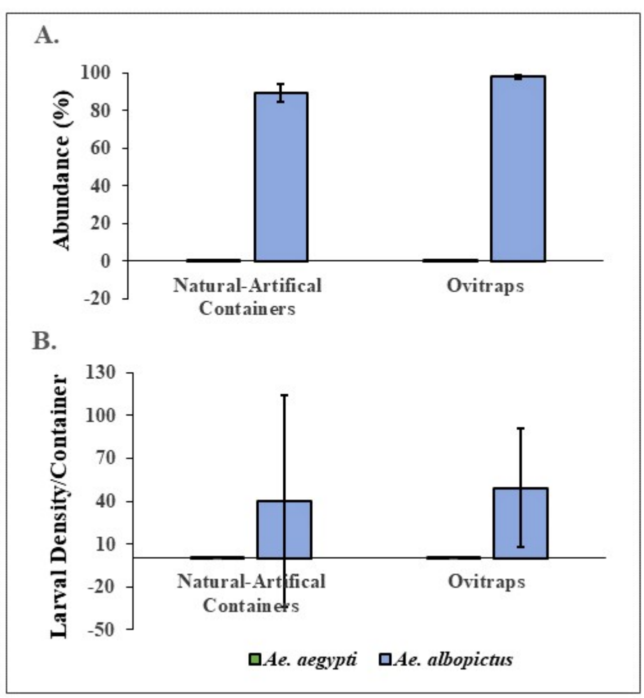

Fig. 2 A. Relative abundance (%) (mean ±SE); B. Larval density (mean ±SD) of *Ae. aegypti* and *Ae. albopictus* in the surveyed water-holding containers and ovitraps from the four blocks of Siliguri sub-divisional area

between October and November, 2022. Ten (5 in each site) water-holding containers in each block (whether natural or artificial) supporting *Aedes* mosquito breeding were randomly inspected for larval sampling. Depending on the habitat size, mosquito larvae and pupae were collected and were brought to the laboratory and reared up to adults (F_0) according to the standard protocol described by Clemons *et al*. (2010). To carry out the entomological surveillance of *Aedes* mosquitoes, standardized ovitraps (oviposition traps) as recommended by CENAPRECE (2015), were installed in each site of the four blocks. Five ovitraps in each site, thus 10 per block were placed with water ($^3/_4$ filled) both in the interior or exterior of the houses as per protocol mentioned by Hernández–Rodríguez *et al*. (2020). A total of 40 ovitraps were installed and the same number of water-holding breeding habitats were inspected for the study. Life history features of fourth-instar larva and all hatched adult mosquitoes were critically analysed under a Magnus Stereoscopic Binocular Microscope, MS-24 for morphological identifications. Systematic identification was done using an *Aedes* based standard morphological key (Rueda, 2005; Tyagi *et al*., 2015). Larval density index (Silver, 2008; Gopalakrishnan *et al*., 2013) and relative abundance (Gopalakrishnan *et al*., 2013; Selvan *et al*., 2015) were calculated to determine the abundance of these mosquito vectors in this region.

Larval density = total no. of individuals of a species/ total no. of positive habitats

Relative abundance (%) = (total occurrence of lavae belonging to a species/total number larvae collected) X 100

Later the mean larval density and relative abundance of the two *Aedes* species among the natural-artificial and ovitrap samples were compared using the independent T-test.

In the survey, 20 out of 40 containers (50%) and 29 out of 40 ovitraps (72.5%) were found as positive breeding habitats of *Aedes* spp. In total, 886 mosquito specimens were collected from the natural and artificial containers in Siliguri sub-division, of which only two individuals were of *Ae. aegypti* and 804 were *Ae. albopictus*. From the ovitraps installed 1490 mosquito individuals were sampled, of which two individuals were *Ae. aegypti* and 1434 were *Ae. albopictus*. Among the natural and artificial containers, larval density (mean ±SD) of *Ae. aegypti* was 0.1 ±0.3 and *Ae. albopictus* was 40.2 ±73.78, whereas in ovitraps larval density of the two mosquitoes were 0.06 ±0.37 and 49.44 ±41.86 respectively. Relative abundance (%) (mean ±SE) of *Ae. aegypti* was 0.72 ±0.55 and *Ae. albopictus* was 89.40 ±4.68 in the natural and artificial containers and in ovitraps were 0.32 ±0.32 and 98.09 ±0.99 respectively. All statistical analysis, was perfomed at a confidence interval of 95 per cent ($p \leq 0.05$). No significant difference in larval density (p= 0.579) and abundance (p= 0.091) of *Ae. albopictus* immatures was found among the natural-artificial containers and ovitrap samples. Similarly, no significant difference in larval density (p= 0.760) and abundance (p= 0.521) of *Ae. aegypti* immatures has found in variance of the natural-artificial containers and ovitrap samples.

Results revealed that *Ae. albopictus* was the more abundant, whereas *Ae. aegypti* was in minimalist proportions in both type of habitats during the two dengue-pick months. In majority of the cases, these two mosquito species were not found in the same habitat although their habitat parameters were identical and they often show sympatry. Rather the mean larval density and abundance of *Ae. aegypti* immatures were significantly in lower side where *Ae. albopictus* has already occupied the habitat. It might be assumed from that, *Ae. albopictus* is replacing *Ae. aegypti* as predominant mosquito-vector in shared breeding containers (whether natural or artificial) of Siliguri sub-divisional area, very similar to the several recent findings that proclaiming the same fact over the globe (Hashim *et al*., 2018; Foster and Walker, 2019; Zhou *et al*., 2022).

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