RESEARCH HIGHLIGHTS

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- Throughout the study region, a dominance of *Ae. albopictus* over *Ae. aegypti* was noticed.
- In this study, it was found that for both the *Aedes* species, discarded tyres were the most preferred breeding habitat resulting highest positivity indices followed by uncovered cemented tanks.
- For *Ae. albopictus*,the natural habitats were also preferred such as bamboo stumps and plant axils.
- Higher larval densities were recorded for *Ae. aegypti* in Islampur, New Mal and Siliguri. Similarly, for *Ae.albopictus* very high larval densities were observed for Nagrakata, North Bengal University, Hasimara and Alipurduar.
- To minimise the disease risk in areas where high larval densities were noted, proper control measures should be planned before the disease outbreaks season by mosquito breeding habitat destruction.
- Majority of the studied *Ae. aegypti* populations possessed low resistance levels against temephos but higher resistance ratios. One population NDP^{ae} was found to possess incipient resistance against 0.02ppm and resistance against 0.0125ppm temephos.
- Widespread resistance against DDT was revealed in all the tested populations of *Ae. aegypti* with the mortality 47.9% for DAR^{ae} population, 55.4% for APD^{ae}, 56.6% for NDP^{ae}, 70.0 % for COB^{ae} and 72.0% for JPG^{ae}.
- The population APD^{ae} reported moderate resistance against malathion with 72.5% mortality followed by incipiently resistant DAR^{ae} with mortality 92.6%.

- Most of the studied population were revealed to be susceptible or incipiently resistant to lambdacyhalothrin and deltamethrin with the mortality ranging from 80.9-100% and 89.2-100% respectively.
- Wide spectrum of resistance was noted against permethrin, with mortality as low as 50% for NDP^{ae} to 83.3% for APD^{ae} population.
- Three of the tested *Ae. aegypti* populations were found to be severely (DAR^{ae}: 50.0% mortality)to moderately resistant (NDP^{ae}: 75.4%mortality) against propoxur.
- Against DDT most of the populations showed high values of both KDT_{50} and KDT_{95}were recorded in majority of the tested populations of *Ae. aegypti* against DDT indicating its inefficacy in mosquito control.
- Amongst the pyrethroid insecticides, high KDT values were recorded against permethrin, with the highest KDT_{95} value for NDP^{ae} population, *i.e*. 192.11 mins.
- Prior exposure to 4% PBO before DDT was found to increase susceptibility to it in APD^{ae} population, restoring the mortality rate 24.6%.Thus a part of the observed resistance might be conferred by detoxification through Cytochome P450s.
- Against malathion, Carboxylesterases were revealed to drive the resistance (though partially) in APD^{ae} population elevating the mortality from 72.5% to 94.0% when exposed to 10%TPP,.
- Against deltamethrin and lambdacyhalothrin, Cytochrome P450s were recorded to be responsible for partial resistance in APD^{ae}, JPG^{ae} and NDP^{ae}.
- Carboxylesterase linked pathways were revealed to be involved in propoxur resistance in NDP^{ae} , as use of 10% TPP could restore its mortality from 45.4 to 70.4% .

- The activity of α-CCEs and β-CCEs were noted to range 1.07 fold to 3.11and 1.19 to 2.46 folds respectively among the field populations than the control population, *i.e.* SP^{ae}. The activity of CYP450 monoxygenases were noted to be 1.14 to 1.53 fold than SP^{ae}. The activity of GSTs were uniform amongst the field caught populations of *Ae. aegypti* ranging from 1.06 to 1.39 times higher than that of SP^{ae}.
- Through kdr genotyping, both susceptible and mutant kdr allele were revealed to be present amongst the wild populations of *Ae. aegypti*. The frequency of the 1534C mutantallele was 50, whereas the frequency of the 1016G mutant allele was 45%.
- Throughout the tested field populations of *Ae. aegypti* around five different isozymes of α-Carboxylesterase (Rf values 0.62, 0.68, 0.73, 0.82, 0.97) and three isozymes of β-Carboxylesterase (Rf values 0.62, 0.80 and 0.96) were found.
- The highest number of isozymes of both the Carboxylesterases were recorded in NDP^{ae} population, whereas the rest possessed a single isozyme (with varying intensities) in both the electrophoregrams.
- Amongst the tested field caught populations of *Ae. albopictus*, only one of the eleven tested population (NGK^{al}) exhibited incipient resistance against temephos at 0.02 ppm dosage. For the India Government recommended dosage of 0.0125 ppm, two populations possessed incipient resistance, NGK^{al} and SLG^{al} .
- Amongst the field populations of *Ae. albopictus*, the LC_{50} values ranged from 0.0001 to 0.0047 ppm. Similarly, the LC_{99} values were found to be in the range of 0.038 to 0.081 ppm.
- Severe to moderate resistance against DDT was revealed in the tested *Ae. albopictus* mosquitoes, namely SLG^{al}, JPG^{al} and NGK^{al}.

- However, complete susceptibility was recorded among the wild *Ae. albopictus* mosquito populations against malathion, deltamethrin and lambdacyhalothrin.
- Moderate level of resistance against permethrin was found in two of the *Ae. albopictus* population with mortality percentages 75.4 (APD^{al}) and 75.0 (JPG^{al}).
- Severely resistant population of Indian *Ae. albopictus* against propoxur was revealed in this study for the first time with very low mortality, 42.5%.
- As in *Ae. aegypti*, similar high values of KDT_{50} and KDT_{95}were noted against DDT, whereas low knockdown times were noted amongst the same mosquitoes population against deltamethrin and lambdacyhalothrin.
- Populations NGK^{al}, JPG^{al} and SLG^{al} were reported to possess Cytochrome P450 linked resistance against DDT, since prior exposure to PBO restored the mortality/susceptibility in these populations 15.1%, 19.7% and 41.25 % respectively. Similarly, in APD^{al} and JPG^{al}, CytochromeP450s were revealed to confer resistance against permethrin.
- Significantly higher activity of α-CCEs were noted in NGK^{al}, SLG^{al}, $JPG^{al}$and NMZ^{al} population. Similarly, for β-CCEs higher activities were noted for NGK^{al}, SLG^{al} and APD^{al} population, *i.e.* 3.16, 2.83 and 2.74 folds than SP^{al} respectively. The activity of CYP450s monoxygenases were recorded to range from 1.03 to 1.94 times SP^{al}. The activity of GSTs were found to be ranging from 0.305 to 0.385 µM mg $protein^{-1}$ min^{-1} .
- The results of kdr genotyping revealed that, all but one (SLG^{al}) tested Ae. albopictus population were found positive for 1534C mutant allele reporting the frequency of this allele to be 29.8%.
- Two different isozymes for both α- carboxylesterases (Rf values 0.81, 0.91) and β-carboxylesterases (Rf values 0.63 and 0.95) were found amongst the different field

caught mosquito populations. Isozymes α-Est II and β-Est II were more prevalent than the other isozyme. In case of α- carboxylesterases, NGK^{al} and JPG^{al} exhibited the presence of both the isozymes, whereas in were expressed in β- carboxylesterases SLG^{al} possessed both the isozymes.