



Anthropogenic Factors Driving Recent Range Expansion of the Malaria Vector *Anopheles stephensi*

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The malaria vector *Anopheles stephensi* is found in wide tracts of Asia and the Middle East. The discovery of its presence for the first time in the island of Sri Lanka in 2017, poses a threat of malaria resurgence in a country which had eliminated the disease in 2013. Morphological and genetic characterization showed that the efficient Indian urban vector form *An. stephensi sensu stricto* or *type* form, has recently expanded its range to Jaffna and Mannar in northern Sri Lanka that are in proximity to Tamil Nadu state in South India. Comparison of the DNA sequences of the *cytochrome oxidase subunit 1* gene in *An. stephensi* in Jaffna and Mannar in Sri Lanka and Tamil Nadu and Puducherry states in South India showed that a haplotype that is due to a sequence change from valine to methionine in the cytochrome oxidase subunit 1 present in the Jaffna and Mannar populations has not been documented so far in Tamil Nadu/Puducherry populations. The Jaffna *An. stephensi* were closer to Tamil Nadu/Puducherry populations and differed significantly from the Mannar populations. The genetic findings cannot differentiate between separate arrivals of the Jaffna and Mannar *An. stephensi* from Tamil Nadu or a single arrival and dispersion to the two locations accompanied by micro-evolutionary changes. *Anopheles stephensi* was observed to undergo preimaginal development in fresh and brackish water domestic wells and over ground cement water storage tanks in the coastal urban environment of Jaffna and Mannar. *Anopheles stephensi* in Jaffna was resistant to the common insecticides deltamethrin, dichlorodiphenyltrichloroethane and Malathion. Its preimaginal development in wells and water tanks was susceptible to predation by the larvivorous guppy fish *Poecilia reticulata*. The arrival, establishment, and spread of *An. stephensi* in northern Sri Lanka are analyzed in relation to anthropogenic factors that favor its range expansion. The implications of the findings for global public health challenges posed by malaria and other mosquito-borne diseases are discussed.

Keywords: *Anopheles stephensi*, coastal zone, insecticide resistance, malaria, mosquito adaptation to anthropogenic habitats, mosquito range expansion, urbanization, vector biology