



Article

# Infestation Pattern and Population Dynamics of the Tropical Bed Bug, *Cimex hemipterus* (F.) (Hemiptera: Cimicidae) Based on Novel Microsatellites and mtDNA Markers

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**Abstract:** The tropical bed bug, *Cimex hemipterus* (F.), has now emerged as an important public health pest in the tropics. Despite its alarming infestation rate, the information on its population genetics remains scarce. Here, we described the infestation structure and population dynamics of *C. hemipterus* in the tropics, especially Malaysia and Singapore, based on eight novel microsatellites and two mtDNA markers, including cytochrome c oxidase I (COI) and 16S rRNA genes. Across populations, microsatellite data revealed high genetic diversity with significant genetic differentiation and restricted gene flow. Analysis within populations revealed evidence of a recent bottleneck. Nonetheless, elevated genetic diversity in nearly all populations suggests that the propagule in *C. hemipterus* populations were much diverse, distantly related (mean  $r = 0.373$ ), and not significantly inbred (mean  $F_{IS} = 0.24$ ) than that observed in *Cimex lectularius* from previous studies. We observed seven mtDNA haplotypes across the 18 populations studied ( $Hd = 0.593$ ) and several populations displayed more than one matrilineal descent. The two markers were generally congruent in suggesting a common, genetically diverse (especially at the nuclear region) source population with possibilities of multiple introductions for the bed bug populations in the present study.

**Keywords:** bed bug; *Cimex hemipterus*; microsatellite; mtDNA; population genetics; infestation dynamics

## 1. Introduction

The bed bug is a nocturnal blood-sucking ectoparasite that has now emerged as an important public health pest globally [1]. All mobile stages of bed bugs feed exclusively on blood from various hosts including humans, domesticated animals, birds, and bats for development and growth [2]. This insect is known for causing physical, psychological, and medical complications in humans [3–5]. Several studies had reported that bed bugs may act as competent vectors for various pathogens, including *Bartonella quintana* and *Trypanosoma cruzi*, that cause trench fever and Chagas disease, respectively [4,6,7]. However, direct evidence for disease transmission to humans is still lacking.

Bed bugs were largely eradicated in most parts of the world during the post-World War II era due to wide scale use of pesticides, especially DDT and malathion [8]. Nevertheless, during the late 1990's, bed bugs made a comeback and their infestations have been rapidly spreading globally [1]. Few theories have been suggested in this regard including the increased rate in global travel and insecticide resistance [9,10]. Some of