Biology, health impact, and management of bed bug (*Cimex lectularius*) infestations in healthcare, residential, and hospitality setups

Abstract:

Bedbug (*Cimex lectularius*) is an important pest in living rooms including hospitals, dormitories, homes and hotels. All the nymphal and adult stage taking blood from human and other animals. They distributed all over the world. They travel from one country to others by travelling instruments. Bedbugs have been suspected of transmitting infectious agents. There is some evidence that arboviruses may be transmissible. There are several measures for control of bedbug including environmental management, using different WHO recommended insecticides. There are several reports of insecticide resistance in this species. Monitoring and mapping of insecticide resistance is an important measure for bedbug control for choosing appropriate insecticides. In addition to use insecticide, other methods such as biological control, genetically methods and other recommended methods should be used for control of bedbug.

Keywords: Bedbug, medically importance, control

Introduction

"Bed bugs belong to order of Heteroptera and family Cimicidae. They affect many vertebrates. They have 23 genera, and around 91 species. Most common pest of humans is *Cimex lectularius.* All are dorsoventrally flattened. They are cosmopolitan in distribution (Fig.1). They are wingless, reddish brown bug - 5-8 mm in length, 3 pair of legs are thin and modified for running. Ocelli absent, antennae have 4-segmented , beak and tarsi have 3-segment. Beds bugs are cosmopolite insects. Isolated cases, clusters, or epidemics of bedbugs have been reported in most big cities on all continents" [1, 2, 3]. "Bedbugs can also travel longer distances by being transported by humans in clothing, luggage, or furniture" [9-14].

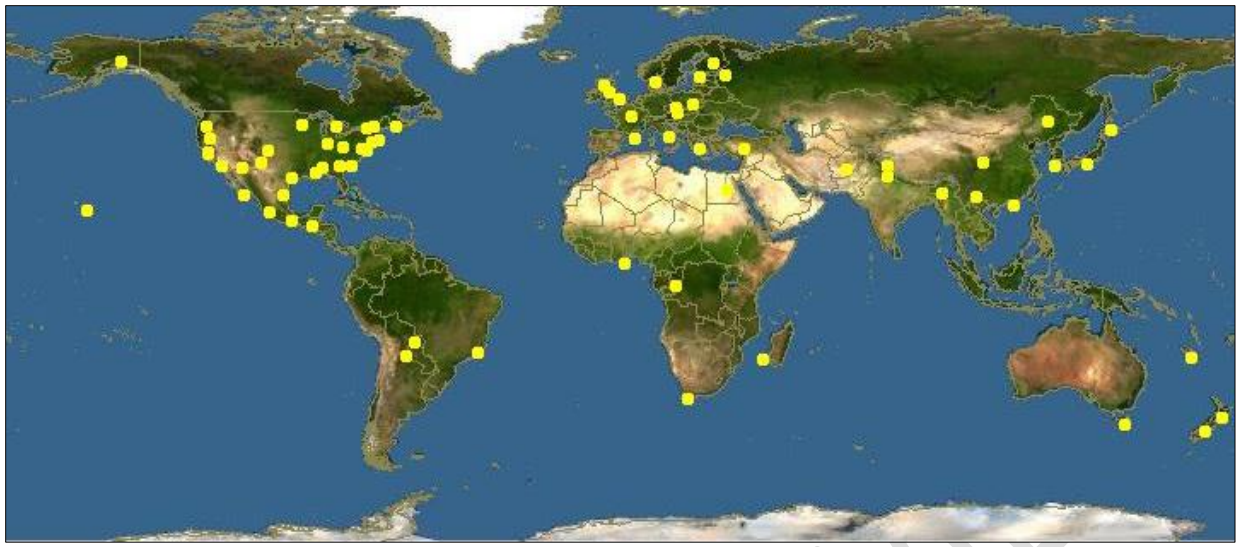

Fig.1. Global distribution of Bedbug (*Cimex lectularius*)

Bed bug biology: Life cycle including: egg, 5 nymphal instars, and adults. All of them are obligate blood feeders. Nest ectoparasites (harborages within ~6' from host) (Fig.2).

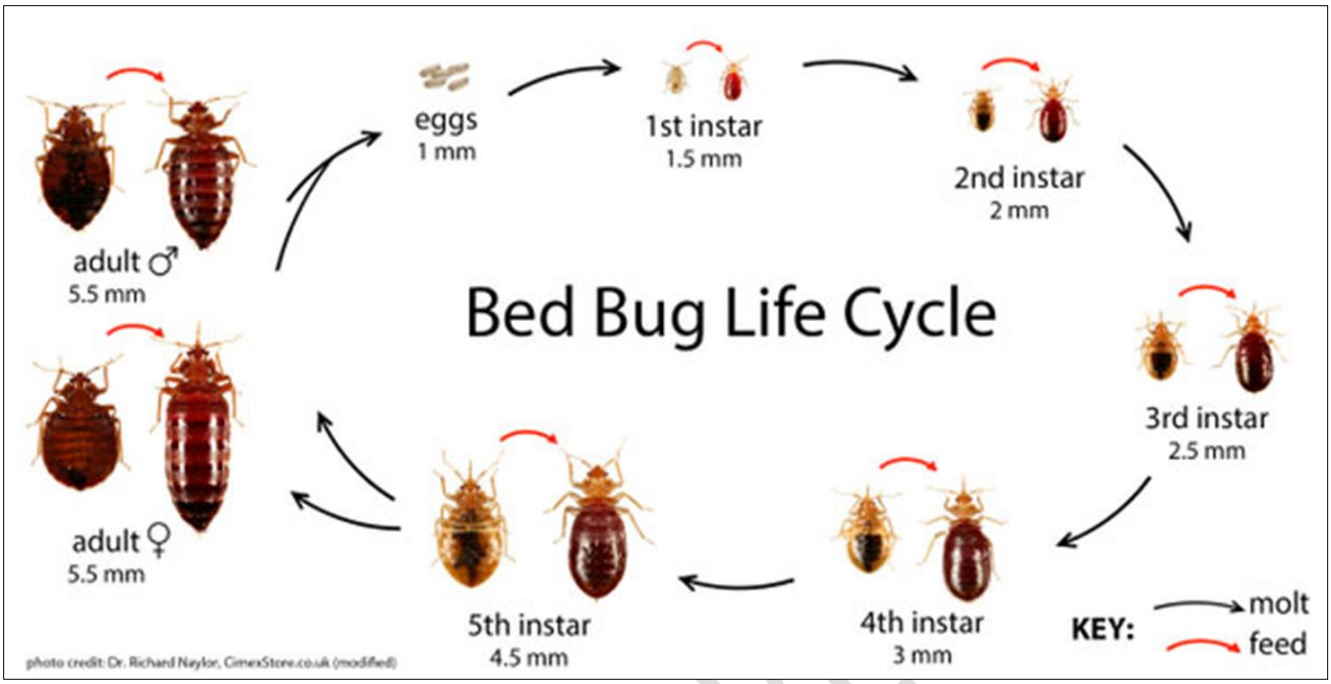

Fig.2. Life cycle of bed bug (*Cimex lectularius*)

Female produces up to 500 eggs. They can survive one year without blood meal. They hide during the day, active by night. They produce foul smelling substance when disturbed. Males are easily recognized by fang-like at the posterior end of abdomen. Copulation is by traumatic insemination. Females are identified by presence of Berles organ in the 4th abdominal segment. Lays 3 to 5 eggs a day. Total days from egg to adult is about 30 at 80.6˚ F. They have 5 molts from nymph to adult. They can live well over 6 months without feeding (some reports over 18 months). 1st instar nymph is about the size of a period at end of sentence. Eggs are 1-2 mm.

Breeding and hiding places of bedbugs: Bed bugs are found in homes, apartments, hotels, cruise ships, dormitories and shelter (Fig.3)

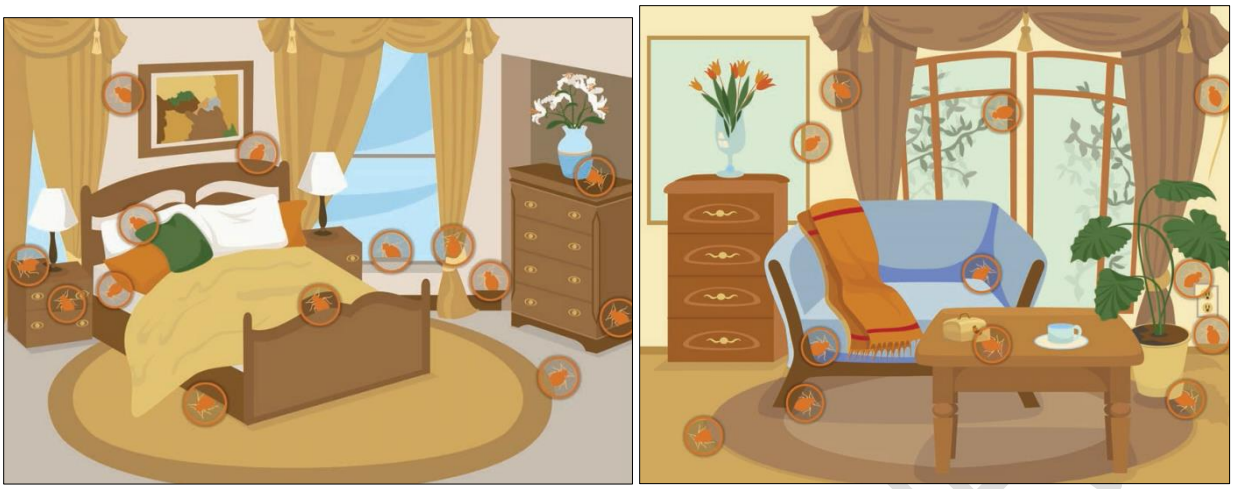

Fig.3. Breeding places of Bedbug (*Cimex lectularius*)

Bedbug bites: Bed bugs feed on blood as their only source of nutrition. In order to mature into adults, they must feed once during each of their immature stages. Adult females also need blood in order to produce eggs. Bedbugs do bite humans (Fig.4).

Fig. 4. Bites of bedbug

Bedbug and transmission of diseases

Bedbugs have been suspected of transmitting infectious agents; over 40 microorganisms have frequently been considered strong candidates including : *Bacillus anthracis , Bartonella quintana, Borrelia recurrentis , Borrelia duttoni , Brucella melitensis Midichloria mitochondrii , Coxiella burnetii* (Q fever) , *Francisella tularensis, Leptospira spp ,Mycobacterium leprae* , Mycobacterium tuberculosis , *Rickettsia africae , Rickettsia conorii , Rickettsia prowazekii ,Rickettsia rickettsii ,Rickettsia typhi , Salmonella typhi ,Staphylococcus aureus , Streptococcus pneumonia , Wolbachia spp ,Yersinia pestis ,Aspergillus flavus , Penicillium spp , Scopulariopsis sp*p , Parasites (filariasis) *,Brugia malayi , Wuchereria bancrofti ,Mansonella ozzardi , Onchocerca volvulus ,Leishmania braziliensis ,Leishmania donovani ,Leishmania tropica,*

Plasmodium spp ,*Trypanosoma cruzi* ,*Trypanosoma gambiense* , Hepatitis B,Hepatitis C,Human immunodeficiency , O'nyong-nyong , Polio, Rabies , Reovirus , Variola (smallpox) , and Yellow fever [4].

Control of Bedbug

"Checking and dismantling all furniture to access all bedbug hiding places, to identify and destroy eggs, nymphs, and adults" [5]. "Some methods can minimize the risk of infestation or expansion: regular inspections, hygiene procedures, and general education of the population. Complementary measures include modifying room temperature, destroying nearby bat or bird habitats, eliminating peeling paint and plaster, and caulking cracks and crevices in walls and furniture" [5,6]. "World Health Organization recommended the following insecticides including : Bendiocarb, Flufenoxuron, Methoprene, Chlorpyifos ,Malathion ,Pirimiphos-methyl, α-Cypermethrin, β-Cyfluthrin, Bifenthrin ,Cyfluthrin ,Cypermethrin, Cyphenothrin, Deltamethrin, Lambdacyhalothrin, Permethrin, Diphenothrin, Resmethrin, Tetramethrin" [7] "Insecticide resistance has been demonstrated experimentally and is an increasing problem" [8]. "Control of bedbugs consists of applying interior residual sprays or dusts to harbourages and to the surfaces over which the bedbugs crawl to reach the host" [15-18]. "Bed frames and slats, both wooden and metal, the welted seams and buttons of mattresses, cracks and crevices in walls and floors, door and window frames and joints in furniture should be treated" [19,20].

Conclusion:

The results of information will provide a guideline for control of bedbug in the world. Monitoring and mapping of insecticide resistance is an important measure for bedbug control for choosing appropriate insecticides.

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Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

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