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Review Article

The resurgence of bedbug infestation: a review of biology, behavior and multi-faceted impacts on human health

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ABSTRACT

Infestation by Bedbug whose origin is traced back to antiquity is a global public health menace common in densely populated dwellings. Bedbug is a blood sucking insect which is attracted by warmth and Oxygen from human host. The feeding is basically nocturnal through unique routine pattern. It is a slightly flat-oval crawling insect with other unique features. This review aimed to highlight key literature findings on the impact of resurgence of the infestation with respect to biology, behavior, potential to transmit diseases, and on various facets of human life. The selection of articles for review was based on the title, the date of publications and the subtopics. The articles that met the selection criteria were picked and interrogated. The review was conducted thematically where issues were grouped together and a central theme emerged. The review interrogated existing literature and paid attention to methodology, findings, discussions conclusions and recommendations. Findings are that control of bed bug has challenged most interventions through decades because of the insect thrift adaptive behavior; the manner the affected individuals shun talking about the attacks; and the resistance to the existing pharmaceutical products. The review further determined that bed bugs harbor a number of pathogenic organisms but their potentials to cause diseases has not been conclusively documented. The infestation has impacts on public health, economic, and individuals' quality of life. The Conclusion is that the eradication of bedbug menace is doable by involving multisector approach enforced by government policies. It is recommended that eradication strategies should target individual empowerment.

Keywords: Infestation, Obligate, Molting, Ectoparasite, Health, Prevention

INTRODUCTION

Human infestations by insect pests-bed bugs, body louse, and jiggers were believed to be a reflection of Diogenes syndrome's aspect of self-neglect.[1,2] Bed bugs are ectoparasitic insects that are in close bilateral association with human environment.[3] Their species are estimated to be around 90 worldwide and the main culprit adapted to human environment is the common bedbug (Cimex lectularius). They have an extended geographical dispersion worldwide and for many years, they have been of significant public health concern.[4] The global resurgence of bedbug infestation is a worrying social and public health phenomenon. Against the backdrop of control strategies, bedbug infestation has persistently challenged control measures in many parts of the world. Different regions have varied figures with developing regions leading with higher statistics. Massawe et al points that approximately 20% of the world population have experienced or encountered bed bugs infestation.[5] Studies on bed bugs are therefore critical because, a part from the persistent resurgence, not much has been

revealed on their potential to transmit human diseases, however their presence on human body has physical, psychological and economic impacts on the infested individuals. This review aims to highlight key literature findings on the impact of bedbug infestation resurgence with respect to biology, behavior, potential to transmit diseases, and on various facets of human life: health, economic, public health and the ultimate sustainable methods of effective control measures.

METHODS

The articles for the review were selected by their titles, subheadings and year of publication. Articles that met the criteria were selected. The main ideas were generated thematically and finally summarized in points in the various sections.

Biology of bedbug

According to Deku et al, Bed bug is a small wingless parasitic insect from the genus Cimex (Cimex lectularius) common bedbug and (Cimex hemipterus) tropical bedbug.[6] Morphologically, the insect has an oval shape with flattened body, the size range between 1 millimeter (mm) and 7 mm (average 5 mm). It has long, short thick antennae, dark protruding eyes and wing-like structures on both sides of the head.

The immature bed bugs are similar to the adults except for a yellowish colour (figure 1 A). The color of bed bug ranges from a white light tan to deep brown or burnt orange (specifically adults are reddish-brown, while the immature stages have light yellow color). After feeding, the color changes to dark red or black blob (figure 1B). Droppings are dark brown or rusty color liquid excrement which stain materials. Bed bugs have five developmental life stages: the egg, instar nymph, nymph, lava, and an adult stage.

A B

Figure 1: (A) bed bugs and (B) fully fed bed bug.

The Instrar nymph has five molting stages marked by changes in color and size from egg hatching to adulthood. The eggs look like tinny pale poppy seeds. In stage One, the nymphs are tiny, about 1.5 mm long almost transparent, and yellowish-white.

In stage two, the nymph is slightly larger than the first, but still quite pale. Stage three is marked by a tanner color and larger size. In stage Four, the color becomes darker and the size is noticeably larger. In the last stage Five, nymph is close to an adult size and is reddish-brown in colour (figure 2).

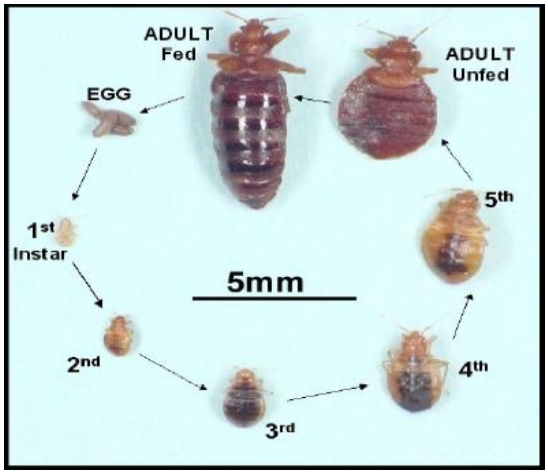

Figure 2: Bed bug life cycle.

Each of the stages ends with the nymph molting (shedding exoskeleton) to allow for growth. The entire stage cycle can take several weeks to a few months depending on temperature and availability of blood meals. The life span of a bed bug ranges from four months to six months. Some may live up to one year under cool conditions.[7] Bedbug body structure marked by extremely flattened Body, specialized mouthparts (Proboscis), flexible abdomen, tough Exoskeleton, vestigial wings, Setae (Sensory Hairs), hooks on Legs, size and color changes, allows them to survive in their parasitic lifestyles by hiding in extreme seclusions, evade detections, and feed on human blood efficiently. Any control intervention should be directed towards these aiding areas.

Habitat: how bed bugs choose a home

Bedbugs were once believed to be associated with unhygienic surroundings, but now it is known that they can set up homes or hide in any property and thrive in any environment that has or is close to a source of food: the human blood.[8] They are more prevalent in densely populated areas or buildings, particularly in multi-occupancy buildings with high resident turnover, such as hostels, hotels, holiday camps and blocks of flats. They are not limited to homes, but infest dwelling places both private and public, clean or dirty, healthcare facilities, public transport systems, waiting halls or closets and other places where people often congregate. They hide in sleeping areas, crevices in the surrounding furniture, behind skirting boards, under loose wallpaper, behind pictures and in plug sockets, among others. The optimum temperature for an adult to survive is between 21°C-32°C, but they can survive in extreme temperature ranges from 0oC (zero) to 49°C. It is therefore eminent that high standards of environmental hygiene could be among the effective control strategies, a fact supported by U.S.

Environmental Protection Agency, Michigan Bed Bug Working Group, and Fong et al.[9-11]

Bed bugs feeding pattern

Bed bugs are obligate ectoparasitic micro predators of humans and Bats, with a strictly hematophagous diet.[12,13] They are basically nocturnal insects attracted to humans by the host body warmth, Carbon dioxide exhaled in the breath, aldehydes, certain chemicals found in human sweat specifically lactic acid, 1-octen-3-ol (octanol), and geranyl acetone (C13 H22O). In an attempt to evade being noticed and to avoid disturbances, bed bugs often feed when the hosts are a sleep.

Their peak feeding time is between midnight and early morning (5.00 am). The process of their feeding includes piercing the host skin using a piercing mouth pad (proboscis) then injecting the saliva containing a mixture of anaesthetic Nitrophorin (NP1-NP4) which reduces pain sensation and an anticoagulant protein, apyrase (C221 H342 N54 O61) which prevent blood from clotting thus allow free flow. One feed takes between 5 and 10 minutes and once fed, the bug will redo the cycle after every 5 to 10 days. They are reported to go for long period (i.e. from 80 to 140 days or to approximately 300 days) without feeding.[8,14,15] Manov point that in the process of evolution, bed bugs have recombined markers in their DNA structure to develop quicker metabolisms which is believed to play a role in their questionable inability to transmit human diseases.[16] It is pointed that bed bugs' digestive systems are highly efficient at breaking down blood components, which also destroys most microorganisms they ingest, thus prevent pathogens from surviving long enough to be transmitted.

Diagnosing bed bug infestation

Bedbugs are diagnosed by recognizing any or combination of the following indicators: numerous excreted small black, reddish-brown or clusters of dark fecal spots (about 1mm wide) that looks like an ink dot usually found on the bed frame, upholstery or the bottom side of the mattress; small blood smear stains on the bed linen, headboard, behind the painting panel; multiple bed bugs with different life stages especially small brown insects hidden in the baseboards in and around the bed frame or sleeping area visible during the day - this is the most obvious but not always the first sign to find or see; huge quantity of exoskeletons shed in bed mattress; Colonized bedbugs behind wall-sheets; Bedbug molt-skins; pale-white eggs; empty eggshells - quite small but still visible to the eye; presence of eggs, or nymphal stages on bed, mattress, and the area around the bed.[17,18]

Their bites produce typical rows of red irritating patterns of straight line or zigzag red bumps on the uncovered areas of the body- the neck, shoulders, back, legs or arms. Skin changes depending on complexion range from small reddish pigmentation to prominent blisters. The effect of the bites varies from person to person, but often cause welts and swelling that are itchier and longer-lasting than mosquito bites.

Figure 3: Grouping of bed bugs.

Evolution of bed bug

Records of antiquity report fossils in Egypt dating back to 1500 BC and records in Algeria affirms that bedbugs had been human parasites for over 350 years. Greece and Roman Empires implicated bedbugs menace as early as 400 BC while Aristotle mentioned them as early as 350 BC.[12-15] These reflect the chronic nuisance of bedbug dating back to the ancient civilizations.

The prevalence of bed bugs at the beginning of the 20th century was due to factors associated with significant rise in human population, and the introduction of electric heating systems which favored the survival temperatures. There was however, little mention of bedbugs throughout the middle ages except for brief mentions in Germany and France in the 11th and 13th century respectively, bedbugs were rarely noticed in England until the 17th century when it is believed they were introduced by imported supplies to rebuild London after the great fire of 1666.[19] The insect posed a significant problem to military bases during World War II but they were controlled by fumigation using Zyklon Discoid that released hydrogen cyanide gas and Dichlorodiphenyltrichloroethane (DDT) to which they later became resistant. Despite being nearly eradicated in developed countries, after World War II, infestations increased from the 1900s and now they are relatively common in all regions of the globe.[20]

Spread and distribution of bedbugs

Globally Bed bugs are found everywhere in the world. The two-cosmopolitan species, Cimex lectularius, and C. hemipterus, are responsible for significant outbreaks of infestations. The common bed bug (Cimex Lectularius) which adapts well to human environment but which also infest birds (chiroptera), chicken (gallus), sheep and bats (hemipterus) is found more in the tropical and temperate climates. Akhoundi indicates that Cimex lectularius

inhabit temperate regions of the Nearctic and Palearctic areas while C. hemipterus is prevalent and familiar in the tropical and subtropical regions.[8] Both species have been found to migrate outside their traditional geographic areas such that besides tropical regions, C. hemipterus has expanded to other temperate zones in the Middle East, North Australia, the United States, Russia, Sweden, Italy, and France. Similarly, C. lectularius has been reported from Madagascar.

Risk factors that have contributed to the explosion in infestations over the last three decades has possibly been due to increased international travels, increased human migration, expanded markets for second hand goods, greater focus on control of other pests resulting in the neglect of bed bug counter measures, banning of certain pesticides which were toxic to the general ecology and increased resistance to the pesticides still permitted, sharing public means of transportations especially those that carry large number of passengers. The rise in infestation has been hard to crack down because the infestation is not an easily identifiable problem and also because the affected persons are often shy to talk about it. The problem may be more severe in all nations than what is documented in reports 21. Studies on harbourage confirm that bedbugs show an innate preference for dark, low-reflective hidings over bright or high-wavelength environments specifically black blue and red.[22,23] It is therefore prudent to be keen on non-attractive colors for residential dwellings

The potential dispersal capacity is reported by Thinhinane to be travellers or migrants.[12] Since bed bugs live or spend most of their time in varied habitats close to humans, they spread passively or actively by being carried by or crawling to personal items.

Health implications of bedbugs

Bed bug infestation is an issue of public health discourse responsible for psychosocial and clinical disorders in humans.[24-26,8] The socially disadvantaged and the poorer sectors of the society who are often the reservoirs of bed bugs are among the most negatively impacted.[4] Primitive beliefs and practices in the 18th century associated the use of bed bugs with the treatment of hysteria, snake bite, and ear infections, however there is no proof of their medicinal efficacy. Contrary to popular belief on vectoral role, a study by Akhoundi, revealed that bed bugs harbor more than 40 infectious agents which include bacteria (Borrelia recurrentis, B. duttoni, Coxiella burnetii, Rickettsia rickettsii); fungi (Aspergillus); viruses (hepatitis B and HIV), and parasites.[8] The first evidence of experimental infection of C. lectularius by Trypanosoma cruzi was reported by Blacklock in 1914.[27] The competence of C. lectularius to act as a biological vector of T. cruzi (agent of Chagas disease) and Bartonella quintana (agent of trench fever) has been demonstrated in the laboratory.[28] Several disease agents have been detected in the feces of bed bugs, specifically T. cruzi, Bacillus anthracis, Francisella tularensis, Brucella melitensis, B. abortus, and B. suis, Salmonella paratyphi, Yellow fever, Smallpox and Lymphocytic choriomeningitis viruses. There is however no evidence of Cimex species transmitting pathogenic agents even in endemic areas. This is associated with the highly efficient digestive systems which destroys most ingested microorganisms from surviving to be transmitted, pathogenic microbes must be grounded to be able to cause disease.[29] Clinically, bed bug bites present varied pathological signs which often affect individuals psychosocial, Immunological and dermatological reactions with ultimate changes in the quality of life.

The psychosocial effects include embarrassment, distress, discomfort, shame, disturbed sleep and withdrawal of associations which all prevent timely seeking for help. The rapid multiplications creating colonies with coriander-like odour when crashed often elicit psychological distress. The presence or citing bedbug on households is psychologically dehumanizing. Skin pigmentations arising from the bites always elicit psychological discomfort in most people. The affected individuals often get stigmatized and hence develop a tendency to withdraw from communal engagements because of shame and ultimate depression.

The Immunological reactions are due to body allergic responses to saliva proteins (nitrophorin and apyrase) released from C. lectularius salivary glands during feeding time. The dermatological effects vary clinically from no reaction to overt features. In order of magnitude they include no reaction, minor (bump) reactions, maculopapular rash, papule, nodular pigmentations, vesicle, bullae, erythema, edema, eczematiform lesions, scratching lesion. Secondary bacterial infections through scratched broken skin may also arise. Some of these features may not be distinct in dark skin and more specifically where skin care is poor. Related differential diagnosis need confirmation by experts. Skin conditions often attract strong negative psychological reactions. Treatment for infections is directed towards signs and symptoms and the ultimate eradication of the bugs. Medications for the skin rashes should be prescribed by a physician. It is worth noting that although bed bugs can harbour various pathogens, transmission to humans has not been proven and is believed to be unlikely. Everyone reacts differently to a bed bug bite; some develop red, irritating marks and lumps, while others do not react to the bites. Secondary infections are possible when skin get broken from scratching.

Control measures

Control of bed bug infestation has remained a significant challenge in public health for a number of reasons and factors. Since the impact does not elicit overt clinical manifestations and may, in most cases not warrant hospitalizations, the affected individuals often take it lightly. Control strategies should therefore be directed

towards personalized commitment and even with pharmacological supplementation.

Control of stigma

Stigma transforms bedbug infestations from a physical issue into a social and psychological crisis, linked to misconceptions about hygiene that cause shame and under-reporting.

This stigma leads to social isolation, delayed treatment, conflict, and negative mental health impacts, including depression and post-traumatic stress disorder. In the affected persons control of stigma should be among first priorities because it is a factor that prevent disclosure for help.[30-32] The affected persons who often feel embarrassed, need to be de-stigmatized so as to empower them to be proactive in putting up control measures.

Poverty reduction

Control of poverty through economic empowerment can engage people towards effective eradication strategies. Poverty contributes to bed bug infestations because of economic, environmental, and financial vulnerabilities that make control measures difficult. The lower-income groups often bear a disproportionate burden of the infestations.[33] Poverty eradication strategies are varied. Sutherland highlight strategies focusing on the following:[34]

Implementing building: Wide, Proactive IPM: This employs regular inspections of all units rather than waiting for complaints, use of monitoring tools like interceptors under bed legs, regular unit inspections, and educating tenants on early detection, using non-chemical methods (steaming, vacuuming, mattress encasements) combined with targeted, minimal, non-residual dust applications - more feasible for low-income housing.

Providing resources and financial support: Uses subsidized Services: housing authorities or public health agencies providing free or subsidized pest control, mattress encasements, and bed-bug-safe, non-chemical supplies to residents; providing services to help washing/ decluttering (Unit Prep) which is a major barrier for the elderly or the disabled.

Education and community-based awareness: Involve distributing educational materials in multiple languages on how to identify, report, and prevent the spread of bed bugs, especially in multi-unit buildings; Educating residents on the dangers of buying secondhand furniture and how to manage laundry in public, shared, or low-cost laundry facilities.

Social support and collaborative care: Integrating pest management with social services, health providers, and community outreach programs to assist residents who are overwhelmed by, or in denial about, their infestation.

Regulatory and housing improvements: Landlords and housing authorities urged to adopt strict, long-term, proactive, and non-toxic, proactive management plans rather than relying on quick-fix, high-toxic insecticide sprays, which can cause resistance in the bugs.

Environmental hygiene

Clean environment allows for early detection and makes it difficult for bedbugs to hide and thrive.

A number of prevention agencies advocate for good environmental management to stop and or reduce the resurgence of the bugs.[9,32-37] Among the proposed strategies include: -

Removal of hiding spots (decluttering): denies bed bugs the opportunity to thrive. Favorable clutter include cracks, crevices, clothes, books, and magazines from the floor, drastically reduces potential harborage sites, making it easier to identify and treat infestations.

Regular cleaning and vacuuming: live bugs and eggs can be physically removed through daily or weekly cleaning, vacuuming of mattresses, box springs, and the surrounding floor area of along baseboards, carpet edges, and upholstered furniture.

High-heat laundering: Frequent washing and drying bed linens, blankets, and clothing on high heat (at least 60°C or 140°F) for 30 minutes kills all stages of bed bugs, including eggs.

Encasing mattresses: Placing mattresses and box springs in zippered, bed bug-rated, "allergen-rated" encasements prevent bugs from hiding in them and makes it difficult for them to feed.

Sealing items: Use of vacuum bags and laundry, in plastic bags, reduces the risk of spreading bugs to other rooms

Personal hygiene

Maintaining high standards of personal hygiene, particularly when traveling or returning from high-risk areas, can significantly reduce the risk of introducing and spreading them. Bed bugs are attracted to human scent, warmth, and carbon dioxide, not filth, but they hitchhike on clothing and luggage.

Centers for Disease Control and Prevention, and other stakeholders, Pest Line, Rutgers New Jersey Agricultural Experiment Station, U.S. Environmental Protection Agency, Virginia Department of Agriculture and Consumer Services, British Pest Control Association, Hestiningsih et al offers the following preventive recommendations:[9,38-43]

Immediate laundering upon return: Wash all clothing including those that were not worn in high heat for at

least 30 minutes. High heat (at least 140°F) kills all life stages of bed bugs, including eggs, which are often missed by casual inspection.

Managing laundry items: Wash bed sheets, blankets, and pillowcases at least once or twice a week, if an infestation is suspected. Keep dirty laundry in sealed plastic bags or a sealed hamper, as bed bugs are attracted to the odors on soiled clothing.

Personal protective habits when traveling: Action: Upon arrival at a hotel, inspect the room and keep luggage on a metal luggage rack away from the bed or in the bathroom.

Cleaning as a detection tool: Regularly vacuum mattresses, bed frames, and furniture to remove bed bugs and eggs. While cleaning does not prevent bugs from entering, it reduces the number of hiding spots and allows for early detection, making an infestation easier to manage before it becomes severe.

CONCLUSION

Infestation by bedbug is a global near forgotten public health menace common in densely populated dwellings where the poorer segments of the society remain the major reservoir. It affects all age groups but since the bug is keen to avoid detection, it challenges those whose vitality to deal with them are compromised. The bug has no direct major physical health impact except for secondary infections but it has marked psychological, dermatological and immunological reactions on those affected. Its structure and thrift adaptive behavior allows it to challenge control measures and to easily hide in cracks in household wooden goods, walls, beddings especially in mattresses and occasionally under cloth seams. Concerted joint effort by government, civil society and individuals could eradicate bedbug menace.

Recommendations

Since bed bug infestation is primarily experienced at the individual level, multisector eradication and control strategies should focus on individual empowerment, supported by government policies to ensure proactive action. Transport companies should implement regular and strict fumigation measures to maintain safe waiting areas and transport vehicles.

The purchase of second-hand goods should involve thorough inspection to eliminate the risk of infestation through contaminated items. In addition, maintaining high standards of personal and environmental hygiene by all stakeholders in the healthcare system is essential for effective prevention and control.

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REFERENCES

1. Falconnet M. Bed bugs and Diogenes syndrome: a combined problem. Sereni-d®. 2023.
2. Reyes-Ortiz CA. Diogenes syndrome: the self-neglect elderly. Comprehensive Therapy. 2001;27(2):117-21.
3. Akhoundi M, Sereno D, Durand R, Mirzaei A, Bruel C, Delaunay P, et al. Bed bugs (Hemiptera, Cimicidae): overview of classification, evolution and dispersion. Int J Environ Res Public Health. 2020;17(12):4576.
4. Doggett SL. Bed bugs and infectious diseases. Advances in the Biology and Management of Modern Bed Bugs. Hoboken (NJ): John Wiley and Sons. 2018;117-22.
5. Massawe P, Wahhay E, Gideon B, Kitau J, Mushi A. Prevalence of bedbug infestation, crowding and awareness level among government boarding secondary school students in Moshi urban, Tanzania. Research Square. 2020.
6. Deku G, Combey R, Doggett SL. Morphometrics of the tropical bed bug (Hemiptera: Cimicidae) from Cape Coast, Ghana. J Med Entomol. 2022;59(5):1534-47.
7. DeVries ZC, Kells SA, Appel AG. Standard metabolic rate of the bed bug, Cimex lectularius: effects of temperature, mass, and life stage. J Insect Physiol. 2013;59(11):1133-9.
8. Akhoundi M, Zumelzu C, Sereno D, Mirzaei A, Delaunay P, Bruel C, et al. Bed bugs (Hemiptera, Cimicidae): a global challenge for public health and control management. Diagnostics (Basel). 2023;13(13):2281.
9. U.S. Environmental Protection Agency. Top ten tips to prevent or control bed bugs. Washington (DC): EPA. 2025. Available at: https://www.epa.gov/bedbugs/top-ten-tips-prevent-or-control-bed-bugs. Accessed on 09 January 2026.
10. Michigan Bed Bug Working Group. Getting the bed bugs out: before you treat for bed bugs. Lansing (MI): Michigan Department of Community Health; 2010. Available at: https://www.michigan.gov/bedbugs. Accessed on 09 January 2026.
11. Fong D, Bos C, Stuart T, Perron S, Kosatsky T, Shum M. Prevention, identification, and treatment options for the management of bed bug infestations. Environ Health Rev. 2012;55(4):89-102.
12. Djouaher T, Akhoundi M, Hamarsheh O, Sereno D, Chebbah D, Brahmi K, et al. First official report of bed bug (Hemiptera, Cimicidae) infestations in Algeria. Parasit Epidemiol Control. 2024;24:e00335.
13. Benoit JB. Stress tolerance of bed bugs: a review of factors that cause trauma to Cimex lectularius and Cimex hemipterus. Insects. 2011;2(2):151-72.
14. DoMyOwn. Bed bug behavior and habits. 2024.
15. Newman T. Everything you need to know about bedbugs. Medical News Today. 2018.

16. Manov B. What triggered the most recent evolution of bed bugs? Bed Bug Hunters & Prime Pest Control. Cherry PM, editor. 2024. https://bedbughunters.co.uk/contacts/
17. Doggett SL, Dwyer DE, Peñas PF, Russell RC. Bed bugs: clinical medicine, entomology and public health. Med Vet Entomol. 2012;26(2):113-26.
18. Shipman KE, Weaving G, Shipman AR. Bedbugs: how to diagnose and manage cases of infestations. Clin Exp Dermatol. 2023;48(5):453-61.
19. Potter MF. The history of bed bug management—With lessons from the past. Am Entomol. 2011;57(1):14-25.
20. Romero A. Moving from the old to the new: insecticide research on bed bugs since the resurgence. Insects. 2011;2(2):210-7.
21. Delaunay P, Blanc V, Del Giudice P, Lévy-Bencheton A, Chosidow O, Marty P, et al. Bedbugs and infectious diseases. Clin Infect Dis. 2011;52(2):200-10.
22. McNeill CA, Pereira RM, Koehler PG, McNeill SA, Baldwin RW. Behavioral responses of nymph and adult Cimex lectularius (Hemiptera: Cimicidae) to colored harborages. J Med Entomol. 2016;53(4):760-9.
23. Singh N, Wang C, Cooper R. Role of vision and mechanoreception in bed bug, Cimex lectularius, behavior. J Med Entomol. 2015;52(2):142-8.
24. Goddard J, DeShazo R. Bed bugs (Cimex lectularius) and clinical consequences of their bites. JAMA. 2009;301(13):1358-66.
25. Goddard J, DeShazo R. Psychological effects of bed bug attacks (Cimex lectularius L.). Am J Med. 2012;125(1):101-3.
26. Benkacimi L, Gazelle G, El Hamzaoui B, Bérenger JM, Parola P, Laroche M. MALDI-TOF MS identification of Cimex lectularius and Cimex hemipterus bedbugs. Infect Genet Evol. 2020;85:104536.
27. Blacklock B. On the resistance of Cimex lectularius to various reagents. Ann Trop Med Parasitol. 1912;6(4):415-28.
28. Salazar R, Castillo-Neyra R, Tustin AW, Borrini-Mayorí K, Náquira C, Levy MZ. Bed bugs (Cimex lectularius) as vectors of Trypanosoma cruzi. Am J Trop Med Hyg. 2015;92(2):331-5.
29. Upadhyay A. Why don't bed bugs transmit diseases? Microbe Investigations. July 23, 2024. Accessed May 15, 2026. microbe-investigations.com
30. Ashcroft R, Seko Y, Chan LF, Dere J, Kim J, McKenzie K. The mental health impact of bed bug infestations: a scoping review. Int J Public Health. 2015;60(7):827-37.
31. Munjita SM, Sitali L, Mwanza J, Kagoli V, Zimba GS. Citizen science in public health: social media insights into bedbug infestations, control methods and psychosocial effects in Lusaka, Zambia. Digit Health. 2025;11:20552076251390559.
32. Roth S, Di Iorio O. "Bed bugs live in dirty places"—how using live animals in teaching can reduce stigma and disgust. CBE Life Sci Educ. 2022;21(4):ar75.
33. National Collaborating Centre for Infectious Diseases (NCCID). Bed bugs: a public health problem?. 2015. Available at: https://nccid.ca/publications/bed-bugs-a-public-health-problem/. Accessed on 09 January 2026.
34. Sutherland C, Greenlee AJ, Schneider D. Socioeconomic drivers of urban pest prevalence. People Nat. 2020;2(3):776-83.
35. New York State Department of Health. Bed bugs – what they are and how to control them. 2024. Available at: https://www.health.ny.gov/environmental/pests/bed bugs.htm. Accessed on 09 January 2026.
36. King County Department of Public Health. Cleaning up a bed bug infestation. Available at: https://kingcounty.gov/en/dept/dph/health-safety/environmental-health/bed-bugs/cleaning-infestation. Accessed on 09 January 2026.
37. Maine Department of Agriculture, Conservation and Forestry. Preventing and getting rid of bed bugs safely. Available at: https://www.maine.gov/dacf/php/gotpests/bugs/documents/BedBugsBrochure-pa.pdf. Accessed on 09 January 2026.
38. Centers for Disease Control and Prevention (CDC). About bed bugs. 2024. Available at: https://www.cdc.gov/bed-bugs/about/index.html. Accessed on 09 January 2026.
39. Pest Line. Are bed bugs due to poor hygiene?. Available at: https://pestline.ca/are-bed-bugs-due-to-poor-hygiene. Accessed on 09 January 2026.
40. Wang C, Cooper R. Cost-effective and money-wasting bed bug control methods. Rutgers New Jersey Agricultural Experiment Station (NJAES). Extension Fact Sheet FS1251.
41. Miller DM, Kells SA. Bed bug action plan for home health care and social workers. Virginia Department of Agriculture and Consumer Services (VDACS)/ Virginia Cooperative Extension. 2014.
42. British Pest Control Association (BPCA). Bed bugs control: how to get rid of bed bugs. A–Z of pest advice. 2017. Available at: https://bpca.org.uk/pest-aware/bed-bugs-control-how-to-get-rid-of-bed-bugs-bpca-a-z-of-pests/189186. Accessed on 09 January 2026.
43. Hestiningsih R, Fauzi M, Sutiningsih D. Bedbug (Cimex spp) infestation in settlements: a cross-sectional survey of sanitation and personal hygiene factors. BIO Web Conf. 2025;193:00038.

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