

Bed bugs on ship: a French review

Annabelle Gressier¹ , Thierry Sauvage^{2, 3}, Frédéric Saunier^{3, 4},
 Brice Lodde^{1, 3, 5} , David Lucas^{1, 3, 5} 

¹Occupational and Environmental Diseases Centre, Teaching Hospital, Brest, France

²Seamen's Health Service, Ministry of Transport, Paris-La Defence, France

³French Society for Maritime Medicine, Brest, France

⁴Seamen's Health Service, Ministry of Transport, Nantes, France

⁵ORPHY Laboratory, University Brest, France

ABSTRACT

Background: Linked to the increase in international travel and development of insecticide resistance, a resurgence of bed bug infestation has been observed since the 2000's and become now a worldwide public health problem. Passenger ships as part of the tourism industry are traditionally infested by bed bugs, but the whole maritime world is now concerned.

Materials and methods: We conducted a short questionnaire-survey among the 22 doctors of the French seafarers' health services to assess the level of this phenomenon in the occupational maritime environment.

Results: Twenty seven per cent of the doctors reported that a patient shared to them a bed bug infestation on board. In that case, all declared that the infestation impacted the patient's life on board. Eighteen per cent responded that a shipowner had already sought their support in face of a bed bug infestation. Lastly, 27% considered that bed bug infestation is an increasing problem.

Conclusions: Bed bugs infestation on board has a major impact on the seafarers and passengers, and significant economic consequences. Preventive measures need to be implemented to limit the risks of dissemination. It is essential to inform and educate seafarers on best practice.

(Int Marit Health 2022; 73, 2: 73–76)

Key words: bed bug, ship, seaman, pest control, prevention, naval medicine

INTRODUCTION

The bed bugs are hematophagous arthropods from the Cimicidae' family gathering two species: the common bed bug, *Cimex lectularius*, and the tropical bed bug, *Cimex hemipterus*. They feed on vertebrates' blood and grow from an off-white larva of 1 mm to, at the adult stage, a red brownish ovoid insect who measures between 5 to 7 mm long. The growth is delayed by cooler temperatures or the lack of food. Their lifetime is usually 4 to 5 months, but they can survive 2 years without feeding [1].

Their bites are painless, with variable response from no reaction to papular urticaria or systemic reactions [2, 3]. Skin lesions generally resolve within a week, and are usually treated by antihistamines, topical and/or

systemic corticosteroids. If scratched and not treated, chronicity or superinfection can appear. Then, topical or systemic antibiotics should be discussed [4]. Actually, there is no evidence of pathogen transmission from bed bugs to humans [4, 5].

Due to their limited size and photophobia, the bed bugs are difficult to detect since during the day, they hide in dark places such as baseboards and furniture, especially bed bases and mattresses or those made in fabric, paper, and wood. At night, they are attracted by the carbon dioxide exhaled and the body heat and attack preferentially humans. Deprived of wings, they are able to fly or jump [2] and are usually conveyed on board by passengers and seafarers' luggage and others belongings.



David Lucas, MD, Centre Régional de Pathologies Professionnelles et Environnementales, CHRU Morvan, 2 avenue Foch, 29200 Brest, France, tel: +33(0)298223509, fax: +33(0)298223959, e-mail: david1.lucas@developpement-durable.gouv.fr

This article is available in open access under Creative Common Attribution-Non-Commercial-No Derivatives 4.0 International (CC BY-NC-ND 4.0) license, allowing to download articles and share them with others as long as they credit the authors and the publisher, but without permission to change them in any way or use them commercially.

Table 1. Results of the questionnaire

Questions	Yes	No
During consultation, did a patient shared to you a bed bug infestation on board?	6 (27%)	16 (73%)
If so, did he tell you that the infestation had an impact on life on board?	6 (27%)	16 (73%)
Has a shipowner already sought your support in face of a bed bug infestation?	4 (18%)	18 (82%)
Do you consider that bed bug infestation is an increasing problem?	6 (27%)	16 (73%)

After a phase of decline from the fifties to the nineties, the limitation of the use of human toxic pesticides and the development of resistance did provoke the reemergence of the bed bug [5, 6]. Resistances to dichlorodiphenyltrichloroethane, carbamate insecticides, organophosphates and pyrethroid insecticides are now described [7–11]. The problem has been enhanced by the increase in international travel and is now a worldwide problem [12, 13].

Diversification of infested sites, with prevalence for the tourism industry and private homes, are one of major consequences of the resurgence of bed bugs [3, 14]. As an international mode of transportation, ships have always been a means of dissemination for infectious agents and their vectors [15, 16] such as bed bugs.

Several ship passengers [17–19] and even submarine vessel cases [20] with description of bed bugs infestation have been published in the grey literature, but we only found one scientific article about bed bug and ship. In 2008, Mouchtouri et al. [21] realised a surveillance study about vector species on 21 passenger ships. Three were infested by bed bugs.

To date and to our knowledge, there is no specific recommendation or guidelines for the ships from scientific or governmental structures. However, many passenger ships have well developed Integrated Pest Management systems with training courses for staff members and protocols on insect or rodent infestation management [15]. Moreover, the guide for ship sanitation published by the World Health Organization provides standardised sanitary measures to prevent the spread of diseases agents and their vectors and to respond appropriately in case of outbreak [22].

The aim of our study is to assess reemergence of bed bug in the maritime world.

We held a questionnaire-survey among the physicians of the French seafarers' health services.

MATERIALS AND METHODS

In France, the medical follow-up of seafarers is ensured by a specific occupational medicine department under the supervision of the French Ministry of Transportation. It gathers 22 occupational physicians in local units along the French coast.

To evaluate physicians' knowledge and opinion concerning the bed bug reemergence, we created on Google Forms, a questionnaire survey including five questions:

- During consultation, did a patient shared to you a bed bug infestation on board?
- If so, did he tell you that the infestation had an impact on life on board?
- Has a shipowner already sought your support in face of a bed bug infestation?
- Do you consider that bed bug infestation is an increasing problem?
- Do you have any comments?

The responses to the survey were collected from December 2021 to January 2022.

RESULTS

All physicians included answered to the questionnaire. The results are presented in Table 1.

Twenty seven per cent of the physicians reported that a patient shared to them a bed bug infestation on board. In that case, all declared that the infestation impacted the patient's life on board. Eighteen per cent answered that a shipowner already sought their support in face of a bed bug infestation. Lastly, 27% considered that bed bug infestation was an increasing problem.

The comments raised questions over the environmental treatment to eradicate a bed bug infestation and revealed that the French seafarers' health service's physicians are concerned by an eventual risk that bed bugs could be vectors of infectious disease. One of the participants noted that he had to take over bed bugs' infestation twice this year whereas he had never heard of this problem during his entire career. Another physician declared that the problem is underestimated, especially among the fishermen. A comment explained that shipowners rely on private specialized companies to treat bed bug infestations.

DISCUSSION

Our survey showed that bed bugs infestation is a growing issue for French seafarers. While the frequency of infestations appeared still limited, the occurrence of bed bugs has a major impact of board. Ships are occupational and living spaces altogether. Limited living spaces increase

the impact of bed bugs outbreaks, as confirmed by physicians' statements. For example, with a limited number of rooms and beds, it is impossible to avoid their use by ship crews. Moreover, sleep disturbances due to the itching and the anxiety associated to bed bugs bites [8, 23] could lead to professional misconducts and mistakes.

Bed bugs infestations could have relevant economic consequences and are bad press in the tourism industry. However, few shipowners called the French seafarers' health service's physicians on this issue. As expressed by one of the occupational physicians, the bed bugs infestations are probably underestimated.

The limitation of our survey is essentially the bias of selection and declaration, not allowing us to generalise our results.

To prevent infestation, early identification of the insect is primordial, information and education of seafarers especially cruise ship staff are the main relevant axis to develop [3]. In 2014, a survey on the working practices of private- and public-professionals sector in France reported that workers mainly rely on the observation of bed bugs, bed bugs faeces and blood stains on sheets [13].

To limit hiding places for bed bugs, a limitation of furniture and more regularly using plastic items are recommended. Sealing cracks and crevices also limit the non-reachable areas [14].

The first stage of nonchemical control is to dispose of the infested items. When possible, using sealed plastic to avoid spreading during the transportation. Seagoing staff should carefully clean the furniture with vacuum and steam (above 60 °C [140 °F]). The vacuum cleaners need to have a disposable bag, removed in a sealed bag after use [14]. All the laundry should be washed at 60 °C (140 °F).

In case of a proven infestation (30 or more bed bugs), an intervention of specialised professionals is needed for a two-sequence treatment with pyrethroids, insect growth regulators or silicates.

CONCLUSIONS

The resurgence of bed bugs is a public health problem reaching the maritime world. Our survey confirms that bed bugs infestation has a major impact on ship. Implementation of relevant preventive measures to limit the risks of dissemination and education of seafarers on good practices are needed.

Conflict of interest: None declared

REFERENCES

- Punaises de lit en France: état des lieux et recommandations. Centre National d'Expertise sur les Vecteurs; 2015 Sep.
- Doggett SL, Dwyer DE, Peñas PF, et al. Bed bugs: clinical relevance and control options. *Clin Microbiol Rev.* 2012; 25(1): 164–192, doi: [10.1128/CMR.05015-11](https://doi.org/10.1128/CMR.05015-11), indexed in Pubmed: [22232375](https://pubmed.ncbi.nlm.nih.gov/22232375/).
- Bernardeschi C, Le Cleach L, Delaunay P, et al. Bed bug infestation. *BMJ.* 2013; 346: f138, doi: [10.1136/bmj.f138](https://doi.org/10.1136/bmj.f138), indexed in Pubmed: [23341545](https://pubmed.ncbi.nlm.nih.gov/23341545/).
- Goddard J, deShazo R. Bed bugs (*Cimex lectularius*) and clinical consequences of their bites. *JAMA.* 2009; 301(13): 1358–1366, doi: [10.1001/jama.2009.405](https://doi.org/10.1001/jama.2009.405), indexed in Pubmed: [19336711](https://pubmed.ncbi.nlm.nih.gov/19336711/).
- Akhoundi M, Sereno D, Durand R, et al. Bed Bugs (Hemiptera, Cimicidae): Overview of Classification, Evolution and Dispersion. *Int J Environ Res Public Health.* 2020; 17(12), doi: [10.3390/ijerph17124576](https://doi.org/10.3390/ijerph17124576), indexed in Pubmed: [32630433](https://pubmed.ncbi.nlm.nih.gov/32630433/).
- Munoz-Price LS, Safdar N, Beier JC, et al. Bed bugs in healthcare settings. *Infect Control Hosp Epidemiol.* 2012; 33(11): 1137–1142, doi: [10.1086/668029](https://doi.org/10.1086/668029), indexed in Pubmed: [23041813](https://pubmed.ncbi.nlm.nih.gov/23041813/).
- Dang K, Doggett SL, Veera Singham G, et al. Insecticide resistance and resistance mechanisms in bed bugs, *Cimex* spp. (Hemiptera: Cimicidae). *Parasit Vectors.* 2017; 10(1): 318, doi: [10.1186/s13071-017-2232-3](https://doi.org/10.1186/s13071-017-2232-3), indexed in Pubmed: [28662724](https://pubmed.ncbi.nlm.nih.gov/28662724/).
- Romero A, Potter M, Potter D, et al. Insecticide resistance in the bed bug: a factor in the Pest's Sudden Resurgence? *J Med Entomol.* 2007; 44(2): 175–178, doi: [10.1603/0022-2585\(2007\)44\[175:iritbb\]2.0.co;2](https://doi.org/10.1603/0022-2585(2007)44[175:iritbb]2.0.co;2).
- Mamidala P, Wijeratne AJ, Wijeratne S, et al. RNA-Seq and molecular docking reveal multi-level pesticide resistance in the bed bug. *BMC Genomics.* 2012; 13: 6, doi: [10.1186/1471-2164-13-6](https://doi.org/10.1186/1471-2164-13-6), indexed in Pubmed: [22226239](https://pubmed.ncbi.nlm.nih.gov/22226239/).
- Samiei A, Tavassoli M, Mardani K. Molecular analysis of pyrethroid resistance in (Hemiptera: Cimicidae) collected from different parts of Iran. *Vet Res Forum.* 2020; 11(3): 243–248, doi: [10.30466/vrf.2018.90574.2192](https://doi.org/10.30466/vrf.2018.90574.2192), indexed in Pubmed: [33133461](https://pubmed.ncbi.nlm.nih.gov/33133461/).
- Kilpinen O, Kristensen M, Jensen KMV. Resistance differences between chlorpyrifos and synthetic pyrethroids in *Cimex lectularius* population from Denmark. *Parasitol Res.* 2011; 109(5): 1461–1464, doi: [10.1007/s00436-011-2423-3](https://doi.org/10.1007/s00436-011-2423-3), indexed in Pubmed: [21626157](https://pubmed.ncbi.nlm.nih.gov/21626157/).
- Réseau Sentinelles. Etude PULI Consultations liées aux punaises de lit en médecine générale en France métropolitaine, période 2019-2020. Institut Pierre Louis d'Epidémiologie et de Santé Publique, Ministère des solidarités et de la santé; 2020 Jul.
- Jourdain F, Delaunay P, Bérenger JM, et al. The Common bed bug (*Cimex lectularius*) in metropolitan France. Survey on the attitudes and practices of private- and public-sector professionals. *Parasite.* 2016; 23: 38, doi: [10.1051/parasite/2016038](https://doi.org/10.1051/parasite/2016038), indexed in Pubmed: [27605306](https://pubmed.ncbi.nlm.nih.gov/27605306/).
- Parola P, Izri A. Bedbugs. *N Engl J Med.* 2020; 382(23): 2230–2237, doi: [10.1056/nejmcp1905840](https://doi.org/10.1056/nejmcp1905840).
- Mouchtouri VA, Nichols G, Rachiotis G, et al. SHIPSAN partnership. State of the art: public health and passenger ships. *Int Marit Health.* 2010; 61(2): 49–98, indexed in Pubmed: [21154293](https://pubmed.ncbi.nlm.nih.gov/21154293/).
- Tatem AJ, Hay SI, Rogers DJ. Global traffic and disease vector dispersal. *Proc Natl Acad Sci U S A.* 2006; 103(16): 6242–6247, doi: [10.1073/pnas.0508391103](https://doi.org/10.1073/pnas.0508391103), indexed in Pubmed: [16606847](https://pubmed.ncbi.nlm.nih.gov/16606847/).
- Silverstein E, Green M. Are there bed bugs on your cruise ship? *Cruise Critic* [Internet]. 2020 Jan 8. <https://www.cruisecritic.co.uk/articles.cfm?ID=1211&stay=1&posfrom=1> (cited 2021 Dec 30).
- Simms R. Famous Cruise Ship Faces Bedbug-Related Crisis. *Cruise Radio.* 2019 Mar 21. <https://cruiseradio.net/famous-cruise-ship-faces-bedbug-related-crisis/> (cited 2021 Dec 30).
- Gautier V. Sa croisière Costa vire au calvaire à cause de punaises de lit. *Le Parisien* [Internet]. 2016 Dec 20. <https://www.leparisien.fr/societe/sa-croisiere-costa-vire-au-calvaire-a-cause-de-punaises-de-lit-30-12-2016-6508677.php> (cited 2021 Dec 30).

20. Ziezulewicz G. Sailors say this submarine has been ravaged by bedbugs. Navy Times [Internet]. 2021 Mar 10. <https://www.navytimes.com/news/your-navy/2021/03/10/sailors-say-this-submarine-is-being-ravaged-by-bed-bugs/> (cited 2021 Dec 30).
21. Mouchtouri VA, Anagnostopoulou R, Samanidou-Voyadjoglou A, et al. Surveillance study of vector species on board passenger ships, risk factors related to infestations. BMC Public Health. 2008; 8: 100, doi: [10.1186/1471-2458-8-100](https://doi.org/10.1186/1471-2458-8-100), indexed in Pubmed: [18371217](https://pubmed.ncbi.nlm.nih.gov/18371217/).
22. Guide to Ship Sanitation [Internet]. 3rd ed. Geneva: World Health Organization; 2011. (WHO Guidelines Approved by the Guidelines Review Committee). <http://www.ncbi.nlm.nih.gov/books/NBK310819/> (Cited 2022 Jan 28).
23. Susser SR, Perron S, Fournier M, et al. Mental health effects from urban bed bug infestation (*Cimex lectularius* L.): a cross-sectional study. BMJ Open. 2012; 2(5), doi: [10.1136/bmjopen-2012-000838](https://doi.org/10.1136/bmjopen-2012-000838), indexed in Pubmed: [23015597](https://pubmed.ncbi.nlm.nih.gov/23015597/).