

Bedbug infestations acquired whilst travelling in the European Union

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ABSTRACT

The bedbug, *Cimex lectularius* (Linnaeus, 1758) (Hemiptera: Cimicidae), has become an important problem in developed countries in the last two decades, while in developing countries the problem is aggravated by the tropical species *C. hemipterus* (Fabricius, 1803). Its significance in public health is centred on its bites and, secondarily, on its potential role as a vector of diseases. Three cases of invaded dwellings by bedbugs in València (Spain) between 2005 and 2008, occupied by people who had recently travelled, were analysed. The origins of infestation were UK, Spain and Sweden. *C. lectularius* was detected in the three dwellings. Several treatments were necessary to eradicate the bedbugs. Pyrethroids proved to be the most efficient insecticides. All treatments were followed by throwing out infested belongings and the washing and cleaning of the affected objects. The recent re-emergence of bedbugs makes it necessary to take individual precautions during travels. The likelihood of a return with live bedbug individuals in luggage or other belongings has to be taken into account, especially when the insects were observed in the room or bites were discovered in the mornings. It is also essential to make the health care sector aware of the bedbug's re-emergence in developed countries.

Key words: Bedbugs, *Cimex lectularius*, travel, European Union, València, Spain.

RESUMEN

La chinche de cama, *Cimex lectularius* (Linnaeus, 1758) (Hemiptera: Cimicidae), se ha convertido en un problema importante en los países desarrollados en las últimas dos décadas, mientras que en los países en desarrollo el problema se ve agravado por la especie tropical *C. hemipterus* (Fabricius, 1803). Su importancia en salud pública se centra en sus picaduras y, en segundo lugar, en su papel como potencial vector de enfermedades. Se analizaron tres casos de viviendas invadidas por chinches de cama en València (España) entre 2005 y 2008, ocupadas por personas que habían viajado recientemente. Los orígenes de la infestación fueron Reino Unido, España y Suecia. *C. lectularius* se detectó en las tres viviendas.

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Se necesitaron varios tratamientos para erradicar las chinches. Los piretroides se mostraron como los insecticidas más eficaces. Todos los tratamientos fueron seguidos de la eliminación de objetos infestados y el lavado y limpieza de los objetos afectados. La reciente reaparición de chinches de cama obliga a tomar precauciones individuales durante los viajes. La probabilidad de regresar con chinches en el equipaje u otras pertenencias debe ser tenido en cuenta, especialmente cuando los insectos se observen en la habitación o se descubran picaduras por la mañana. También es esencial que el sector de la salud tome conciencia de la re-emergencia de la chinche de cama en los países desarrollados.

Palabras clave: Chinche de cama, *Cimex lectularius*, viaje, Unión Europea, València, España.

INTRODUCTION

The bedbug, *Cimex lectularius* (Linnaeus, 1758) (Hemiptera: Cimicidae), has, unlike the tropical bedbug, *C. hemipterus* (Fabricius, 1803), a worldwide distribution. Both species are haematophagous insects and non-permanent ectoparasites of humans, although they can also feed on other mammals and birds (Usinger, 1966). Adults and nymphal stages bite at night, hiding indoors during daytime, usually in wall-holes and crevices, beds and mattress components. Also, bedbugs have sometimes been found in other wooden furniture and tapestries in bed- and living-rooms, and they might lurk in luggage and clothing of travellers (Reinhardt and Siva-Jothy, 2007). Moreover, adult bedbugs may survive for up to twelve months without feeding, and can complete more than three generations per year.

Human bedbug infestations should be considered a health problem due to: 1) the affections derived from their bites, which can be asymptomatic, or can present a variety of dermatological reactions, from typical papular lesions, sometimes grouped in a line of three, to unilateral bullous lesions (Cleary and Buchanan, 2004), or even, but very rarely, bullous cimicosis, a mediated IgE response against bedbug nitrophenol, injected during the bite (Leverkus *et al.*, 2006); 2) the difficulties when trying to control and eradicate this insect, especially in lodging establishments (hotels, homeless shelters, rooming house etc.). However, to date there is no evidence of bedbug transmission of human pathogens, although the transmission of more than 40 human diseases has been attributed to them, mainly in the laboratory, including the Hepatitis B virus and Chagas disease (Goddard and de Shazo, 2009).

Bedbug infestations became less common in industrialized countries after World War II thanks to the development and use of insecticides and the improvement of hygienic and sanitary conditions. However, since the beginning of the new century, but possibly since the 1990s, the 1980s or perhaps even since the late 1970s (Hallas *et al.*, 1977), a re-emergence of the bedbug has taken place in developed countries, such as the USA (Krueger, 2000; Cleary and Buchanan, 2004; Ter Poorten and Prose, 2005; Anderson and Leffler, 2008), Canada (Hwang *et al.*, 2005), the UK (Paul and Bates, 2000; Boase, 2001, 2004; Whyte *et al.*, 2001; Fletcher *et al.*, 2002; Burgess, 2003), Germany (Liebold *et al.*, 2003), Spain (Fuentes and Sainz-Elise, 2005), Italy (Masetti and Bruschi, 2007), France (Delaunay *et al.*, 2009), South Korea (Lee *et al.*, 2008) and Australia (Doggett *et al.*, 2003, 2004; Ryan *et al.*, 2004), especially related to travels from or to developing countries, and to the incorrect use of insecticides, mainly those of domestic use.

With the aim to shed more light on the transmission and management of human bedbug infestations, the present manuscript reports three cases acquired whilst travelling in the western European Union and introduced to the city of València (Spain).

In all three cases, eggs, nymphal instars or adults belonging to the species *C. lectularius* were found in various rooms, mainly bedrooms, of the infected dwellings (Figure 1). Identification at specific level of these insects was carried out by the Department of Parasitology of University of València (DPUV) according to their morphological and morphometrical characteristics (Usinger, 1966; George, 1988; Schuh and Slater, 1995).

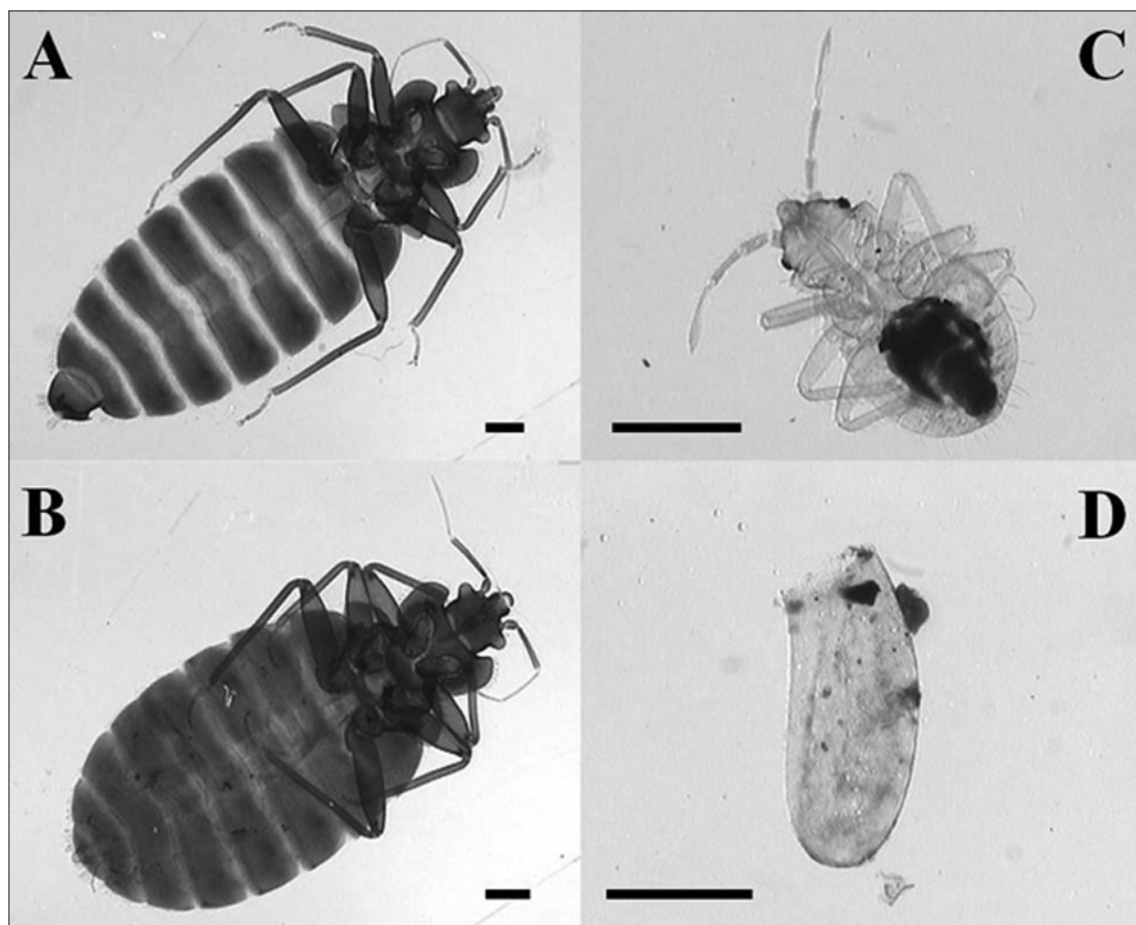


Figure 1. *Cimex lectularius*. A) Male. B) Female. C) Nymph. D) Egg. Bar, 0.5 mm.

CASE 1

A woman from València travelled to London in June 2005 staying at a four-star hotel. During the first night, she discovered bedbugs in the bed and inside her suitcase. The woman changed her accommodation on the following day. Having returned home, she first detected blood stains in her bed and several days later the presence of various bedbug specimens, seemingly adults, although she did not present any apparent bites. Within the same month the room was subjected to an anti-bedbug treatment, repeated one week later, by a specialised company. However, the composition and the manner of application remain unknown. Yet, in December of the same year, bedbugs were detected in the adjacent room of the bedroom and also in another room situated at the far end of the flat, approximately 30 m away, and usually unoccupied.

The woman's daughters and a guest, occupying the aforementioned rooms, suffered bedbug bites, typically presented as a linear or cluster configuration of three to four lesions, with a spontaneous evolution in a week. In January 2006 the same pest control company carried out another treatment, emphasizing on this occasion the efficacy of the insecticides used, which, as previously, did not belong to the pyrethroid group. In June 2006 more bedbug specimens were detected in the two adjacent bedrooms, once again affecting the lady's daughters. The DPUV was informed and the following steps were recommended: getting rid of the wooden moulding behind the bed, followed by an integral treatment of the dwelling with 2% permethrin (nebulization and residual powder), with special emphasis on the affected rooms, but this time carried out by another enterprise. The treatment took place in three ses-

sions (initial, a week, and a month later) observing the 12-hour safety period. This third treatment, carried out in July 2006, was the last one for neither further bedbug specimens nor bites were detected in the dwelling.

CASE 2

In October 2007, a woman undertook a pilgrimage along the St Jacob's Way, lodging in the pilgrims' inns. Whilst spending a night in one of the inns of the Rioja region, some pilgrims were bitten and discovered bedbugs in various rooms. In the next shelter all pilgrims coming from the infested inn were obliged to share the same room. However, in this new shelter some guests suffered typical bedbug bites with spontaneous evolution, and a great many bugs were detected in the shared room. The aforementioned lady continued her pilgrimage but left part of her belongings in the shelter so that they would be sent to her residence in the city of València. Between January and March 2008, larval stages as well as bedbug adults were detected in the lady's built-in wardrobe, in which she kept the belongings used during the pilgrimage, and in the adjoining bedroom. Bedbug specimens were identified by DPUV, who recommended the washing and cleaning of the affected objects, the laundering of bed linens in hot water (60°C, temperature 100% effective against all bedbug stages, as reported by Boase, 2007), and the treatment of the infested rooms with a commercially available insecticide (2% permethrin + 0.2% tetramethrin). This treatment was effective.

CASE 3

Several Erasmus students from València travelled to Stockholm during the first term of 2007, staying at a students' dormitory. In June they received visiting relatives who stayed in the same building. During their stay neither the students nor their relatives observed bedbug specimens or presented bites. However, one week after their return, at the beginning of August, in the dwelling of one of the students, bedbugs were detected in some rooms (bedrooms, lumber room and lounge) and a great many bugs in sockets, which had bitten three of the four occupants of the dwelling who presented the typical bites with a spontaneous evolution. The

owners of the flat first tried to get rid of the plague by spraying an insecticide of domestic use, which proved ineffective. In September respectively October, a specialised company was contracted to carry out two integral treatments of the dwelling with a commercially available insecticide containing 5.5% alpha-cypermethrin. After further episodes occurred in November, the same company carried out a third treatment in March 2008. However, bedbugs reappeared in May. The same company carried out a fourth treatment in June 2008, adding 11% di-flubenzuron to the original insecticide. Once again, in July more bedbug specimens were detected in several rooms. In October 2008, another pest control company, recommended by DPUV, carried out an integral treatment of the dwelling, very similar to the one in case 1, which finally was successful. In this case it is noteworthy that the owners of the flat related the bedbug presence to electric fixtures from the adjacent building which had been derelict for at least 10 years. However, two facts allow for the rejection of this hypothesis and prove their origin: bedbugs cannot survive without feeding for more than one year - a year and a half at the most; and their detection in the dwelling of other students from València in December 2007 who had stayed at the same dormitory in Stockholm.

DISCUSSION

The bedbug is an emerging ectoparasite not only affecting the population of underdeveloped areas but it is also present in big cities in developed countries, where bedbugs use personal belongings to move from one dwelling to another. However, bugs may also migrate from one flat or hotel room to another through holes in walls, water pipes, or gutters (Goddard and de Shazo, 2009). In case 1 bedbugs migrated at least 30 m within the same flat. This is not surprising since other reports previously found similar or even more distant bedbug migrations of between 25 (Fuentes and Sainz-Elipé, 2005) to 65 m (Brown and Brown, 1996), but these findings, as in case 1, could not be unequivocally ascribed to walking (Reinhardt and Siva-Jothy, 2007).

In the three reported cases it has been demonstrated that dwelling infestation by bedbugs took place after a trip either to a place of the same coun-

try (case 2) or to other western EU countries (Great Britain, case 1; Sweden, case 3). The travellers, bar in case 3, had contact, at least visually, with bedbugs during their stay. In cases 1 and 2, there was possibly the presence of more than one bug generation in the infested dwellings, which could have been due to: i) the rapid proliferation of bedbugs having had the chance to feed on their hosts repeatedly; ii) the female's ability to shed more than 200 eggs, in batches of between 10 and 50; and iii) the fact that the completion of their biological cycle, from egg to adult, in optimal conditions, may merely take between 24 days at 30°C to 128 days at 18°C (Usinger, 1966).

The reported cases are unsurprising for bedbug infestations have previously been reported in homes, flats, hotel rooms, hospitals, and dormitories of various western EU countries: in València, Spain (Fuentes and Sainz-Elipe, 2005); in Central Italy (Masetti and Bruschi, 2007); in a hospital nursing home in France (Delaunay *et al.*, 2009); affecting a German citizen travelling in the UK (Liebold *et al.*, 2003). Also, it has been reported that bedbug infestations on the increase in British hotels (Boase, 2007). Furthermore, the annual increment of reports on bedbug infestations in developed countries confirms the re-emergence of this human ectoparasite, making it necessary to take individual and collective precautions, at least during and after business and touristic travels, i.e. reinforcing travellers' awareness as one of the most effective preventive measures.

Bedbugs are extremely difficult to eradicate and pest control issues concerning their eradication procedures have recently been reviewed in detail (Pinto *et al.*, 2007; Goddard and de Shazo, 2009). As demonstrated in the three reported cases, a residual formulation using appropriate chemicals (organochlorines, organophosphates, carbamates, and pyrethroids) making direct contact with all affected surfaces is recommended to eradicate emerging nymphs and also those nymphs and adults not directly treated. During the last decades, the replacement of these insecticides by less toxic insect-specific bait gel traps and hormonal growth regulators resulted in the suppression of the bedbug's natural predators, e.g. the red ant and certain spider species (Ter Poorten and Prose, 2005). Confirmation of live *Cimex* two weeks after appropriate treatment measures is indicative of continued infestations. In this

case, treatment must be repeated preferably using another chemical insecticide group to prevent bedbug resistance. In all three reported cases, bedbug infestations have not been detected again until now, at least two years after the final treatment of the most recent case (October 2008), and consequently bedbug eradication in the affected dwellings should be expected. Nevertheless, bedbug resistance to pyrethroids has recently been reported in some countries, e.g. in the UK (Boase, 2007). The surprising ineffectiveness of 5.5% alpha-cypermethrin (2% permethrin was effective) in case 3 may have been due to the working style of the pest control company rather than a possible resistance to this pyrethroid.

The possible return with live bedbug individuals in luggage as well as other belongings has to be taken into account, especially when the insects are observed in a room or bites, not associated with mosquito or flea presence, are discovered in the morning. However, most people under the age of 50 in the developed world are not able to recognize bedbugs (Reinhardt and Siva-Jothy, 2007). The main precautions to be taken are: 1) checking hotel rooms for signs of infestation (insects or their faecal matter); 2) checking luggage when returning home, and, if necessary, washing clothes in hot water; 3) resorting to a pest control enterprise, in case of infestation, and demanding a complete and effective treatment of the entire dwelling. To reinforce the fight against the bedbug, it is also essential to make the health care sector aware of the bedbug's re-emergence in developed countries and to consider bedbug bites in the diagnosis of those dermatological affections when scabies, fleas, lice or mosquitoes can be ruled out. Infestations are confirmed by identification of bugs, faecal smears or blood spots on bed linens and mattresses. A physical exam of the patient (dermatological signs and symptoms are typical) has to be carried out and his/her history of exposure has to be considered in bedbug diagnosis.

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