

BED BUG (HEMIPTERA: CIMICIDAE) MANAGEMENT IN UK HOSPITALITY SECTOR: OPERATIONAL EXPERIENCE

CLIVE BOASE

The Pest Management Consultancy, Haverhill, Suffolk, CB9 9AF, UK

Abstract This study reviews the bed bug management programme in place across a sample of >500 hotels in the United Kingdom, just prior to the Covid-19 pandemic. In these hotels, regular bed bug detection was carried out by housekeepers, while a professional canine bed bug detection team was used to inspect suspect rooms. Any infestation found was treated by professional pest control companies. The companies followed an outcome-based contract, in which their treatments were required to achieve and maintain eradication for a period of 6 months. They used a combination of heat, insecticide, and desiccant dust. The reports of infestation were seasonal, with a peak in late summer. Infestation was very patchily distributed, with most hotels experiencing no infestation, while a small proportion experienced multiple infestations. The risk of infestation of hotels was substantially increased by having had previous infestation. In a few particularly problematic hotels, an Intensive Care programme was introduced, and initial results indicate that infestation rates at these hotels are much improved. Overall, successful bed bug management was dependent just as much on the monitoring, communication and coordination of the work, as it was on the technical merits of the individual pest control measures used.

Key words Hotel, seasonality, canine, distribution, detection, efficacy, contract, *Cimex*

INTRODUCTION

Since the end of the 20th century, bed bugs (*Cimex lectularis* L.) have become a common pest, and their presence in commercial accommodation can have very significant impacts on business reputation (Penn *et al*, 2017). Research studies have examined the effectiveness of various detection techniques (White, 2017), of insecticides (Kai *et al*, 2017), and of non-chemical techniques such as heat (Pereira *et al*, 2009). Additionally, some integrated bed bug management programmes have been proposed (Bed Bug Foundation, 2013, and Doggett, 2010). However, there have been few assessments of bed bug management on an operational scale. The data presented here were collected over a period of c. 30 months prior to the start of the Covid-19 pandemic, from a large sample of hotels in the United Kingdom which shared a standardised bed bug management process. The objective was to assess the effectiveness of a large operational bed bug management programme.

METHODOLOGY

Hotels and Guests

The hotels included in this study were selected because they were under common management. They were located at over 500 UK locations; in city centres, at airports, in suburban areas, in provincial towns, or in motorway services. The numbers of guest rooms ranged from c. 20 to c. 700 per hotel, with a total of c. 80,000 guest rooms within the sample. The total number of guests using the hotels was 5 – 10 million per year.

Bed Bug Detection

Trained housekeepers examined the rooms daily, while they carried out more detailed six-weekly inspections. All inspections were recorded, any signs were reported to hotel management, and the suspect room(s) was immediately taken out of service. A professional canine bed bug detector team then carried out an inspection of a block of 14 rooms around the suspect room. This organisation was independent of the treatment contractors, so providing an impartial assessment. Bed bug detection devices were not used, as they were likely to attract adverse comments (Cain, 2018). The inspection team's report, if they found bed bugs, formed the basis for the following treatment.

Bed Bug Treatment

No bed bug treatments were applied by hotel personnel. Bed bugs located by the canine inspection team were immediately treated by the dog handler with steam or freezing spray, to prevent any dispersion. Full treatment was carried out by professional pest control companies. An outcome-based contract was established which required pest control companies to eradicate bed bugs and prevent re-occurrence within 6 months. If bed bugs were found within 6 months of treatment, the company was required to eradicate the infestation at their expense. Before the end of the warranty period, rooms were re-inspected by the canine detector team to check if riddance had actually been achieved.

All treatments were applied reactively; no proactive treatments were applied. Treatments were applied to the confirmed infested room, and to the two immediately adjoining rooms. Both pest control companies chose to use heat, insecticides, and desiccant dust, carrying out two bouts of treatment 1 or 2 weeks apart. The insecticides used were pyrethroids, carbamates (now discontinued) and insect growth regulators. All three contractors prepared reports on every inspection or treatment, which were available on-line to the hotel organisation. Regular meetings were held with the three contractors and those responsible for managing the bed bug work. Despite the regular inspections and treatment where required, a few hotels still showed repeated bed bug problems. For these hotels, an Intensive Care programme was developed and introduced. This programme did not fundamentally change the processes, but emphasised the importance of awareness, communication, monitoring and following protocols.

RESULTS

Infestation Nature

Infestations were reported throughout the year, with distinct seasonality, with a peak in August-October (Figure 1).

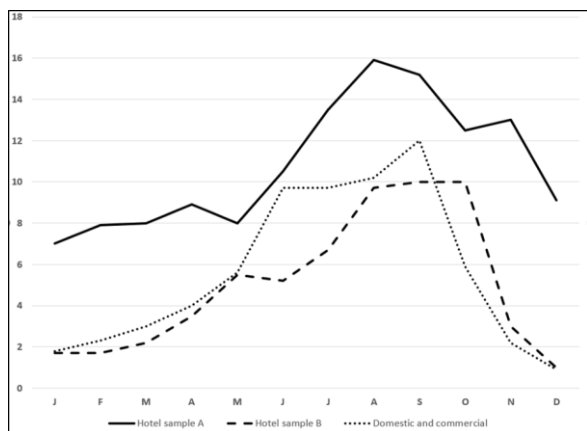


Figure 1. Seasonality of reports of bed bug infestations. Solid line: Data from the hotels in this study. Nos. of infested rooms per week. 2018 – 2019. Broken line: Unpublished data from another large (>100) sample of UK hotels. Nos. of infested rooms per month. 2008 – 2011. Dotted line: Data from Cornwell (1974). No. of bed bug jobs per month/10; domestic and commercial accommodation.

Geographically, there were large differences in the distribution of bed bugs. London hotels were most likely to be affected (66% affected within a year), whereas in Scotland, only 14% were affected. Despite the number of guests through the hotels, bed bug infestations were unevenly distributed across the sample. In each year, most hotels, even large city-centre hotels, did not experience infestations, while 50% of the total infested rooms occurred in only 3% of the hotels. Across the sample of hotels, around 0.2-0.3% of guest rooms were likely to have had bed bugs.

No. of infested rooms in 2019	% of the hotel sample with each level of infestation
0	66
1 - 2	20
3 - 5	10
6 - 10	2
>10	1.3

Table 1. Variation in infestation rates across hotels

Room Access Rates For Inspection

Despite hotels being required to make the designated block of rooms available for inspection, in practice full access was available on only about 45% of reactive inspections. For the proactive inspections, where access to all rooms in the hotel was required, then complete access was obtained at only 2% of inspections.

Detection Effectiveness

The detector dogs found even very small infestations within guest rooms. The accuracy of negative inspection reports was evaluated, and it was found that in 9.5% of rooms that received a negative report, infestation was subsequently confirmed within the following 6 months.

Treatment Effectiveness

Success of the treatments was based on the proportion of treated rooms which remained free of bed bugs for 6 months after treatment. Treatment success ranged from 88 – 95%. Insecticide resistance was undoubtedly an issue, hence the use by both treatment suppliers of heat treatment as well as insecticides. Where infestation did re-occur, it was typically 2 – 4 months after treatment, but was sometimes as long as 15 months later. The pattern of infestation in part of one such hotel is shown in Figure 2, with several rooms (eg 15, 30, 37 and 39) showing delayed reappearance of infestation.

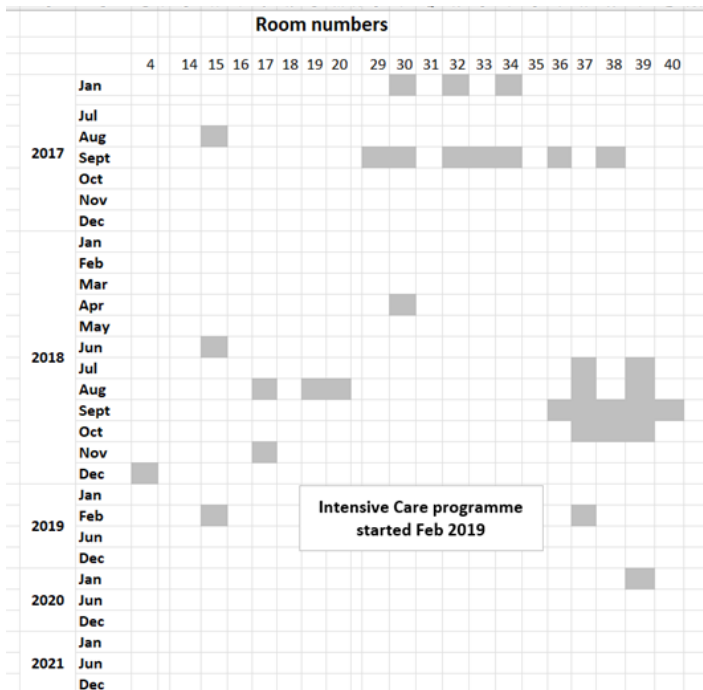


Figure 2. Chronology of infestation in part of one hotel. Grey cells indicate dates and rooms where live infestation was detected.

One example of the impact of the Intensive Care programme is shown in Figure 2. At this hotel, there had been repeated bed bug problems. During the 34 months after implementation, monthly whole-hotel canine inspections were carried out, and many tens of thousands of national and international guests visited. In this period, bed bugs were found in one room only, that had had repeated infestation 15 months previously.

DISCUSSION

Access to large volumes of data on bed bug infestations and treatments enables patterns to be established that would not be apparent from smaller datasets. Although bug infestations in these hotels were reported throughout the year, there was a distinct peak in August-October (Figure 1). This seasonality is consistent with that reported elsewhere eg Cornwell (1974). Studies in Dublin and Tromso (Bokenes *et al*, 2011) confirm that even in modern buildings, August is still the warmest month indoors. Seasonal trends have been reported for other indoor insect pests such as fleas (*Ctenocephalides* spp.) (Cornwell, 1974), German cockroaches (*Blattella germanica*, L.) and Pharaohs ants (*Monomorium pharaonis*, L.) (unpublished data). It is considered that summer pest peaks are better explained by increased indoor temperatures causing faster insect reproduction, than by increased human travel.

The bed bugs in these hotels had a very uneven distribution (Table 1). Had the level of infestation simply reflected the rate of introduction of bed bugs, then a more uniformly distributed but low-level risk of infestation might have been expected. However, individual hotels that had not had any bed bug infestation in previous years, had only a c. 15% chance of developing an infestation the following year, while hotels that had had an infestation in a particular year, had a 64% chance of developing an infestation the following year. This strongly suggests that persistence of infestation is key in creating ‘problem’ hotels, rather than high levels of importation.

The work highlighted bed bugs’ ability to remain undetected for extended periods after treatment, even in frequently inspected guest rooms. Presumably the bed bugs are still present at this time, but in sufficiently low numbers to escape detection. Normally, any survivors might be expected to multiply more rapidly and become apparent sooner, but perhaps the insecticide residues remaining after treatment, slow the recovery of the infestation.

Bed bugs are particularly challenging pests, owing to their behaviour and impacts. Even with a carefully designed programme, there can still be room for improvement. If bed bug levels are to be driven down and guest safety maintained, the work of the many hotel managers, housekeepers, and pest control technicians, needs to be supported, incentivised, coordinated and monitored.

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