

# BED BUG MANUAL



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# Introduction

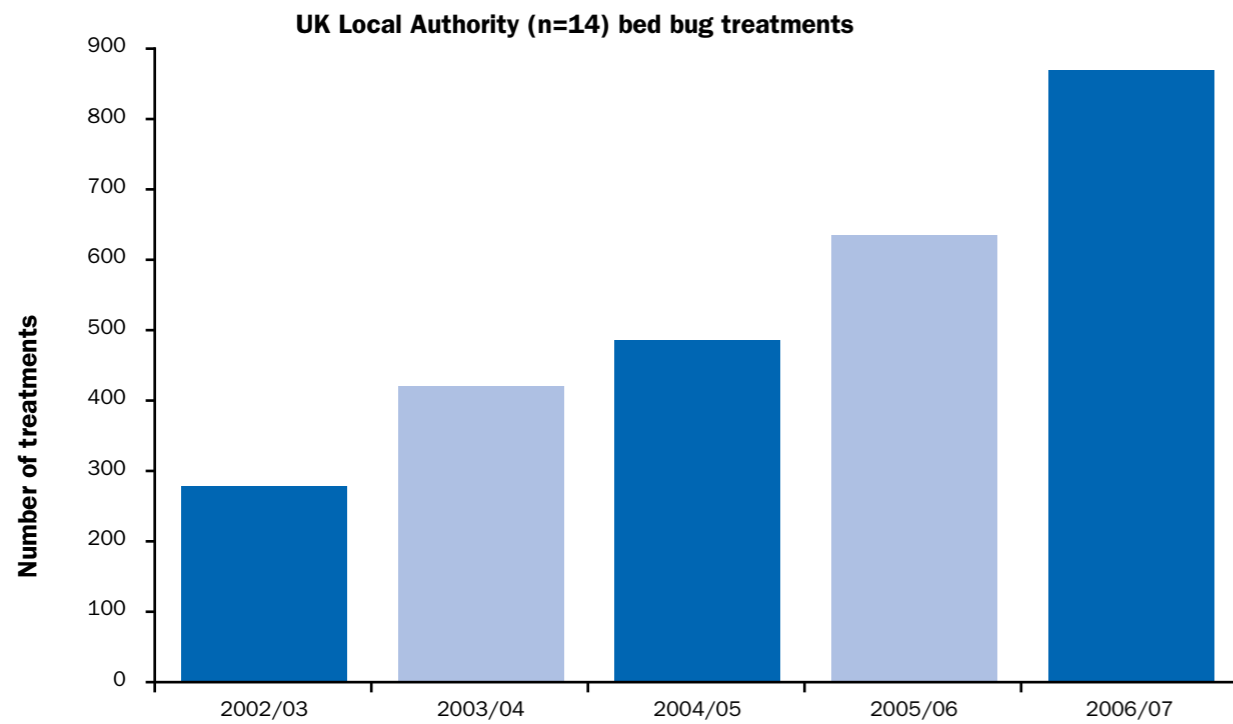
In recent years, UK pest control companies have reported an increase in the number of bed bug, *Cimex lectularius* treatments (Boase, 2001, Boase, 2004) and new preliminary data presented here reinforces this point. Medical journals also report an increase in the number of bed bug samples sent for identification (Paul & Bates, 2000) although Killgerm Chemicals Ltd have received decreasing numbers of bed bugs for identification in recent years. A recent high-profile litigation involving a celebrity American lawyer and a British branch of an exclusive hotel has intensified the spotlight on bed bug control. A number of interim reports of UK bed bug resistance to technical insecticides (Boase, 2006 & 2007) have provoked concern. These factors, coupled with the relative unfamiliarity of pest control companies with bed bug control strategies, are likely to have led to the observed large number of requests for technical advice on how to achieve successful bed bug control, which is one reason why this manual has been commissioned. Furthermore, until now, there did not exist a single reference containing up-to-date details of bed bug biology and control for the UK public health pest control industry, which this document attempts to address. It is also hoped that this document will supplement other work currently being undertaken on bed bugs in the UK.



# New data

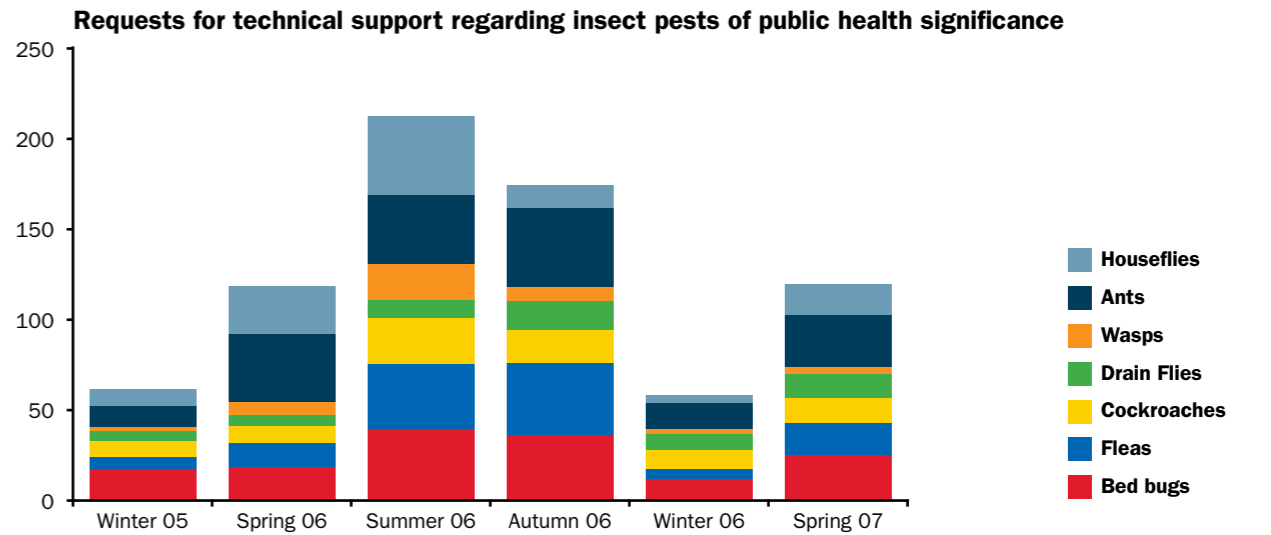
## LOCAL AUTHORITY BED BUG TREATMENTS ON THE INCREASE

Data regarding infestation rates of bed bugs is reviewed in Siva-Jothy, 2007. Here, we present a brief selection of preliminary new data from major local authorities across the UK, showing the number of bed bug treatments undertaken over recent years (London authorities are not included). It is clear that the number of bed bug treatments undertaken in recent years by major local authorities is on the increase. Some data was difficult to acquire, as bed bug treatments were classified under 'miscellaneous insects' by some authorities, so the figures are lost within this category. The recent upsurge in bed bug treatments has led these authorities to record bed bug treatments in their own dedicated category.



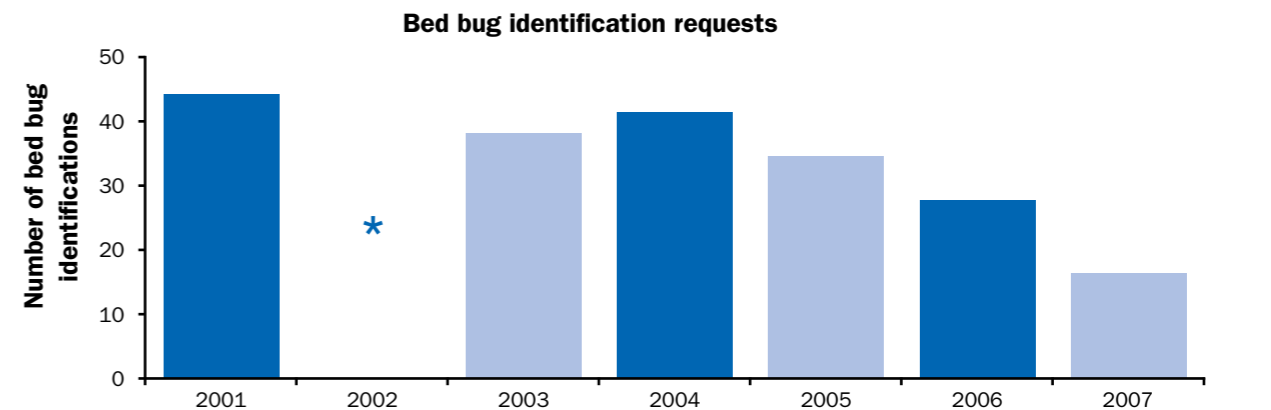
## HIGH PROPORTION OF REQUESTS FOR TECHNICAL SUPPORT

This data shows technical calls dealt with by Killgerm Chemicals Technical Department, relating to bed bugs and selected other insects of public health significance, from December 2005 to May 2007. The number of requests for technical support regarding bed bugs was consistently greater than or equal to the other listed insect pests of public health significance, despite bed bug treatments only being a small fraction of pest control treatments undertaken by local authorities (often only reaching up to 3.5%). The demand for technical support has also led to the development of advanced pest control workshops on bed bug biology and control.



## IDENTIFICATIONS REQUESTED

The number of bed bug identification requests submitted to Killgerm Chemicals Ltd in recent years has remained relatively constant, with even a slight decrease apparent. This possibly reflects, as bed bugs become more prevalent, pest controllers become more familiar with them and are able to identify them with experience. Bed bugs are also relatively easy to identify, due to their distinctive appearance and location. It is important to note that the Killgerm identification service is not a mandatory reporting scheme – pest control companies tend to submit arthropods that they cannot identify themselves. \*Data not available.



# Classification

Bed bugs belong to the family Cimicidae, within the order Hemiptera – the true bugs. There are thought to be 91 species of Cimicidae, grouped into 23 genera. A selection of these is listed below.

**Order:** Hemiptera

**Suborder:** Heteroptera

**Family:** Cimicidae

## Genus *Cimex*

- *Cimex lectularius* (Bed bug) **UK Species**
- *Cimex hemipterus* (*C. rotundatus*) (Tropical bed bug)
- *Cimex pilosellus* (Bat bug)
- *Cimex pipistrella* (Bat bug) **UK Species**

## Genus *Leptocimex*

- *Leptocimex boueti* (Bat bug)

## Genus *Haematosiphon*

- *Haematosiphon inodora* (Poultry bug)

## Genus *Oeciacus*

- *Oeciacus hirudinis* (Martin bug) **UK Species**
- *Oeciacus vicarius* (Swallow bug)

# Origin, History & Distribution

The evolution of obligate haematophagy (feeding only on blood) in the ectoparasitic *Cimex lectularius* seems to have originated and progressed from phytophagous (plant feeding) bugs that would predate by chance or accident, to predatory bugs feeding on invertebrates associated with nesting mammals or birds, to bugs that feed on the vertebrate host itself. The common flower bug, *Anthocoris nemorum*, which predates other insects and is occasionally herbivorous, is an example of a close relative to *Cimex lectularius*. *Anthocoris nemorum* will also pierce human skin and suck blood.

In terms of bed bugs evolving to feed on humans, it has been hypothesised that bed bugs made the switch from bats to Man, when Man was cave dwelling in pre-history.

The ecology of the human race means they are an excellent host for bed bugs, as humans live communally in enclosed spaces, sleep at a predictable time in a predictable place and have high body temperature, are relatively hairless and have a rich blood supply to a relatively thin epidermis.

*Cimex lectularius* is cosmopolitan in distribution and is therefore a worldwide problem.

Bed bugs were first recorded in the UK in 1583 (Usinger, 1966). In 1939 approximately four million people in Greater London were subject to bed bug infestations (Usinger, 1966). Bed bug infestations declined from 1939 onwards, most likely due to the introduction of residual insecticides. One survey showed that the number of bed bug treatments remained approximately stationary from the late 1960's to the early 1970's (Busvine, 1980).



Bed bug nymphs after recent blood meal

# Identification

It is a legal requirement that insects are to be identified before a pesticide treatment can take place.

## “The Protection of Animals Act 1911”, amendment 1927.

Amendment 1927 – Use of poison is prohibited on any land or building except for the purpose of killing pests.

This section provides descriptions, pictures and a key to facilitate identification of bed bugs.

### EGG

Bed bug eggs are approximately 1mm long and 0.5mm wide, with an egg-cap (the operculum). Unhatched eggs are pearl coloured and opaque before hatching, becoming translucent when hatched.



### NYMPH

Nymphs are small versions of the adult form, with a thinner cuticle, which displays the colour of partly digested blood. The bed bugs increase in size from 1.3 – 5.0mm as they pass through 5 instars.



### ADULT

Adult bed bugs are mahogany-brown, oval, dorso-ventrally flattened, wingless insects, which are approximately 5-7 mm in length and possess piercing mouthparts. When unfed, adults are pale, yellow-brown in colour, but after a full blood meal, they take on a darker mahogany-brown colour. Three pairs of walking legs are present, slender but well developed, with efficient tarsal claws for clinging on to the host during feeding. The bed bug's head is short and broad, with a pair of prominent compound eyes, in front of which is a pair of clearly visible 4 - segmented antennae. The proboscis is slender and normally held closely along the ventral surface of the head and prothorax.

Other key points for identification are the 3 - segmented proboscis lying in a ventral groove, ocelli being absent, and the tarsi being 3 - segmented.

Bed bugs are very distinctive and can usually be identified immediately.



### SIGNS OF BED BUG PRESENCE

Cast nymphal skins, hatched or unhatched eggs, straw-yellow, dark brown or black marks (excrement spots, consisting mainly of excess water, with a little blood) and a sickly sweet / coriander-like smell, are all signs that are used to identify bed bug presence, along with customer complaints and evidence of bites.

### KEY (TAKEN FROM MALLIS, 1964)

#### A. Rostrum reaching to coxae of fore-legs

##### 1. Front margin of pronotum deeply concave

###### a) Hairs on body not long. Man the usual host.

1) Pronotum with wing-like expansions, hairs fringing pronotum relatively straight. ...*Cimex lectularius*

2) Pronotum not wing-like, hairs fringing pronotum curve backwards. ...*Cimex hemipterus*

###### b) Body with long hairs, bats are the usual host.

1) In the United States –  
Eastern United States – *Cimex adjunctus*  
Western United States – *Cimex pilosellus*

##### 2. Front margin of pronotum much less concave, body with long hairs, swallows the usual host.

###### a) In the United States – *Oeciacus vicarius*

###### b) In Europe – *Oeciacus hirundinus*

#### B. Rostrum longer, reaching to coxae of hind legs, poultry the usual host. *Haematosiphon inodora*.

# Biology

Bed bugs have well defined resting sites (sometimes referred to as 'refugia') in which many individuals from all the different life stages are found. This harbourage is an essential part of the life cycle of the insect since it is in this area that the young bed bugs pick up the internal microorganisms that are essential to their survival, some of which are also inherited by transovarial transmission through the egg covering. Bed bugs spend the majority of their time in these harbourages, aggregated together under the influence of aggregation substances (which is exactly why targeted crack and crevice treatments are so crucial – see Control section). Alarm pheromones are also emitted in response to stress, causing bed bugs to scatter.

Bed bugs reproduce by traumatic insemination – the male pierces the female abdomen, sperm enters the sperm receptacle and then travels through the blood to reach the ovaries.

## LIFE CYCLE AND BIONOMICS



Bedbugs exhibit incomplete or gradual metamorphosis, from egg, through 5 nymphal stages, to adult. Female bed bugs lay eggs throughout their life, an unusual feature in insects. They generally produce around 2 to 3 per day and since they can live for many weeks, indeed months, each female could produce around 400 - 500 eggs during their lifetime. The eggs are deposited all around the environment in which the bedbug is living. The length of time spent in the five nymphal stages is greatly dependent upon the food resources available (each nymphal instar requires a blood meal for further development), temperature and relative humidity.

The importance of this data is that the temperature dependent life cycle can be manipulated to aid control. In particular, increasing room temperature to 27°C can stimulate eggs to hatch after 5 – 6 days and vulnerable 1st instar nymphs will quickly come into contact with fresh insecticide deposits. It is often thought that higher temperatures will reduce the residuality of insecticides, but at these moderate temperatures this is not the case, especially when microencapsulated insecticides are used. Lower temperatures mean that the time to hatching could be elongated and insecticide deposits are likely to be less effective. Delayed hatching of eggs could also give the false impression that an infestation has been eradicated, only for the bedbugs to reappear in time, especially as the unhatched eggs could remain viable for 3 months and adults can also survive for more than a year without a blood meal.

If temperatures were to drop below 13°C, bed bugs become unable to complete their life cycle, although many properties are heated so bed bugs are a year-round problem.

Under ideal conditions, the life cycle from egg to adult can be as short as 3 weeks.

<i>Cimex lectularius</i> bionomics – Eggs	
Temperature (°C)	Egg hatching time (days)
13	49
15	34
18	21
22	12
27	5 - 6

<i>Cimex lectularius</i> bionomics – Egg to Adult	
Temperature (°C)	Complete cycle (weeks)
13	Not completed
15	34
18	18
22	8
27	4.5

## PUBLIC HEALTH SIGNIFICANCE

The close association of bed bugs with human beings means that they can cause substantial nuisance through their blood-feeding habit. They feed at night on sleeping human hosts. If the infestation is high there can be a risk of anaemia being suffered by infants, although this is rare. The nuisance and itching caused by the bites and the possibility of secondary infection is more common. Bats, chickens and other domesticated animals may also be attacked.

Both male and female, adult and nymphal bedbugs take blood meals and so are equally important as nuisance pests. There is no evidence of bedbugs being involved in the transmission of infections or diseases to humans, and they are therefore not considered to be disease vectors.



Adult bed bug feeding & excreting excess water ingested

Reaction to bites is variable. Some people show little or no reaction whereas others may suffer allergic or other severe reactions (there are some documented cases of anaphylactic shock) and sleepless nights. The biting nuisance is not to be underestimated, especially considering recent high profile litigation, damage to reputation and associated economic losses.

## **FEEDING, HOST LOCATION AND HOST ASSOCIATIONS**

As already stated, nymphal, adult, male and female bed bugs all require blood meals to develop and reproduce successfully. Bed bugs will feed mainly at night when the human host is sleeping, although they may also feed in the daytime if conditions are favourable. On average, a bed bug will feed once every 7 days, although higher temperatures can stimulate more frequent feeding – another added bonus of manipulating the temperature dependent biology is that more frequent attempts to feed are likely to bring bed bugs into contact with insecticide deposits.

Bed bugs generally take 5 – 10 minutes to complete a blood meal and the quantity of blood taken can be many times the weight of the bug.

Bed bugs feed on exposed areas of skin, with most bites typically being found on the abdomen, but also the neck, arms, legs and feet. Multiple lesions are found, often arranged in a linear pattern and sometimes clustered into groups of three. The lesions are varied in appearance, often recognisable as raised reddened swellings, similar to flea bites, although with no central red area.



Bed bugs are thought to locate their host by random searching, followed by orientation to heat, CO<sub>2</sub> and host odours from perspiration and other secretions. These stimuli and possibly aggregation substances could be utilised if successful bed bug traps are to be developed.

Although bed bugs are closely associated and usually most successful when feeding on humans, they can also survive and complete their life cycle on bat, bird, mouse and rabbit blood. Other domesticated and zoo animals may also be attacked (Usinger, 1966).

## **DISPERSAL**

To prevent the spread of bed bugs throughout a domestic property, it is recommended that the client should continue to sleep in the same room until the infestation is eradicated. For hotels and similar premises, this is not an option for obvious reasons, and is discussed in a later section. The presence of a sleeping person in the room also provides a stimulus for bed bugs, likely to lead to more frequent foraging and therefore contact with insecticide deposits.

It is thought that bed bugs disperse via travel, in suitcases, back-packs and also second hand furniture. Areas with a frequent change-over of residents, such as student and institution accommodation, multi-occupancy housing with migrant workers or travellers, seem to be at a higher risk.

## **RESISTANCE**

Recent unpublished interim reports (Boase, 2006, 2007) have shown that bed bug field strains taken from different locations in London exhibit resistance to technical alphacypermethrin and bendiocarb. It is crucial, however, that resistance is not used as an excuse for treatment failure – current results are based on technical insecticide, not formulated insecticide. Formulated insecticide, at recommended application rates, may give higher mortality. Furthermore, many current treatments utilise carbamates



and pyrethroids and feedback indicates that treatment using these chemicals is successful. Experience seems to show that control failure is generally down to other factors, such as poor treatment methods or a lack of understanding of bed bug biology. Some authorities experiencing call – backs to bed bug treatments have simply changed their working practice to be more thorough. After implementing this new strategy, no call – backs were observed. Some authorities commented that their successful bed bug treatments were due to the excellence and skill of their pest control staff.

Resistance is also not a new issue – bed bug resistance to DDT in the 1950's was overcome with new insecticides. If resistance does become a problem in future, it can be overcome with alternative insecticides like insect growth regulators, non-chemical control such as laundering, vacuuming and extreme temperature treatments and a targeted Integrated Pest Management strategy, outlined in the following sections.





• Inspect behind loose wall paper



• Inspect mattresses



• Inspect furniture, removing drawers and checking wardrobes



• Check mattress seams



• Do not forget the underside of mattresses



• Inspect luggage, particularly along fold, seams, zips and buttons



• Check telephones and other electrical equipment



• Remove and inspect light switch covers



• Check behind mirrors

**A flushing agent is an essential part of a thorough inspection, as visual inspection with a torch and/or hand lens will not reveal all bed bugs**

## **PRE-TREATMENT ADVICE TO CLIENTS**

### **Hotels**

#### **GUEST COMPLAINT PROCEDURE**

- Any report of bed bugs should be investigated and recorded.
- Any guest complaining of bed bugs should be immediately relocated, to avoid bites occurring again.
- Prior to relocation, belongings should be inspected for bed bugs (with consent of the owner) and laundered, to minimise the chance of the infestation spreading.
- Medical assistance should be sought if there is a severe reaction to bed bug bites.
- A qualified pest controller should inspect the area (which should be vacated until an inspection is organised) for bed bugs.
- Details of the inspection and action taken should be recorded.
- Ideally, the pest controller should inspect the room before the client removes items. This is so the pest controller can gauge the extent of the infestation.

#### **BED BUG INFESTATION CONFIRMED: ACTION TO TAKE**

- If a bed bug infestation is confirmed, the guest should be provided with advice on how to prevent infestation of their home.
- Guidance on the “Bed bug client checklist” should be followed.

## **BED BUG CLIENT CHECKLIST**

### **Client Responsibilities**

- Loosen the carpet at wall / floor junction, but do not remove it from the room.
- Remove any wall-mounted items but do not take them out of the room.
- Remove plug and switch plate covers. Isolate the supply to the room to avoid electrocution.
- Remove linen from bed and base. These should be bagged and laundered (see laundering procedures in later section).
- Empty wardrobes and cupboards of items.
- Do not remove any items of furniture from the room. In most cases beds can be treated and do not need to be disposed of.
- If a mattress is torn and therefore difficult to treat, it can be disposed of. Discuss this with the pest controller. The mattress should be rendered unusable, sealed and disposed of after being treated with insecticide.

### **After Treatment**

- Replace all items removed from walls.
- Replace carpet.
- Re-assemble room.

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

## **BED BUG CLIENT CHECKLIST FOR PCO**

### **Information for client**

- Bed bug client checklist provided.
- Recommend that rooms to be treated should be taken out of service for a minimum of 7-10 days (if relevant).
- Bed bug fact sheets provided, along with details of insecticides to be used.

### **Customer responsibilities completed**

- Carpet loosened at wall / floor junction.
- All wall-mounted items removed.
- Plug and wall switch plate covers removed.
- Linen removed from bed and ensemble base.
- Items removed from wardrobes / cupboards.

Pest Control Manager: \_\_\_\_\_

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

# Bed Bugs Fact Sheet

## **KEY FEATURES**

Adult bed bugs are 4-8 mm in length, wingless and uniformly mahogany brown in colour. They have long well-developed walking legs with efficient tarsal claws for clinging on to the host during feeding. Prominent antennae project from the head adjacent to the compound eyes.

## **BIOLOGY**

Female bed bugs lay eggs throughout their life, an unusual feature in insects. They generally produce around 2 to 3 per day and since they can live for many weeks, indeed months, each female could produce around 400 - 500 eggs during their lifetime. The eggs are deposited all around the environment in which the bedbug is living and are small and white or whitish/yellow about 1 mm long. The nymph that emerges from the eggs after about 10 days at 22°C is a small version of the adult feeding also on the blood of vertebrates. The length of time spent in the five nymphal stages is greatly dependent upon the food resources available, temperature and relative humidity. Bed bugs have well defined resting sites in which many individuals from all the different life stages are found. This harbourage is an essential part of the life cycle of the insect since it is in this area that the young bed bugs pick up the internal gut microorganisms that are essential to their survival.

## **DISTRIBUTION**

This genus has representatives worldwide.

## **SIGNIFICANCE**

The close association of bed bugs with human beings means that they can cause substantial nuisance through their blood-feeding habit. They feed at night on the human hosts as they are sleeping. If the infestation is high there can be a risk of anaemia being suffered by the human hosts, although this is rare. The nuisance and itching caused by the bites and the possibility of secondary infection is more common. Bats, chickens and other domesticated animals may also be attacked.

## **CONTROL**

A thorough inspection should be made to determine the extent and source of the infestation. Bed bugs may, for instance, have been introduced in second-hand furniture, where bugs may remain undetected for considerable periods until a suitable host appears. All harbourages should be treated with a residual insecticide. A very thorough treatment is needed, as harbourages are diverse and difficult to detect.





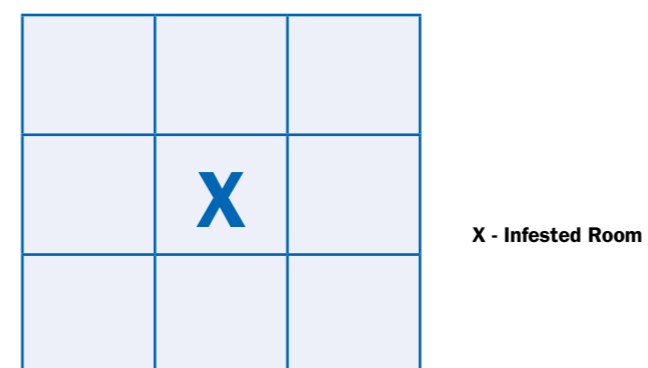
## RECORD OF PESTICIDE APPLICATION

<b>Operator</b>	
<b>Date of Treatment</b>	
<b>Address/ Site of Application</b>	
<b>Areas to which applied</b>	
<b>Reason for Treatment</b>	
<b>Product Used</b>	
<b>Type of Application</b>	
<b>Quantity Used</b>	
<b>Dilution Rate</b>	
<b>Application Rate</b>	
<b>Reference Number</b>	
<b>Other Relevant Information</b>	

## INSECTICIDE APPLICATION

- Use an approved insecticide with correctly calibrated and serviced spraying / dusting equipment.
- Flat fan and crack and crevice nozzles are recommended for broad spray treatments and crack and crevice treatments respectively.
- An appropriate pressure regulator is recommended.
- If insecticide approval allows it (see product label), treat mattresses, around buttons and along seams. Do not use insecticide on bedding.
- Treat the bed frame and bed head, including joins and grooves.
- Treat electrical goods such as telephones, clock radios and televisions with dust.
- Apply insecticide to the wall – floor junction, under carpet edges, where the carpet meets the skirting board and under the skirting board if accessible.
- Apply dust to the inside of all electrical junction boxes. Light switch covers can be removed and treated.
- Treat furniture framework – upholstered furniture can be treated with crack & crevice spray, similar to mattress treatments and dust can be applied to the hollow metal tubing of appropriate furniture.
- Treat items removed from the walls.
- If bed bugs are found in the guide tracks of wardrobes, arrange for these tracks to be pulled up. Treat this area and arrange for the tracks to be re-attached post-treatment.
- Inspect and treat housekeeping rooms.

## BLOCK TREATMENTS



Block treatments are essential in good pest control. All rooms in contact with the infested room should be inspected and treated if necessary. This includes rooms adjacent, above and below the infested room.

It is a good pest control strategy to 'work from the outside, in'. Find the extent and outer limit of the infestation and work inwards towards the focus to gain control.

## INSECTICIDE TREATMENT REGIME

The suggested treatment regime utilises a mixture of insecticide groups and formulations, ensuring an integrated approach to control and resistance management.

<b><i>Cimex lectularius</i> suggested treatment regime</b>	
<b>TREATMENT 1</b> (initial treatment)	<b>Microencapsulated Synthetic Pyrethroid</b> + Pyriproxyfen IGR + Dust
<b>TREATMENT 2</b> (after 2 weeks, or depending on temperature and therefore egg hatch)	<b>Residual Synthetic Pyrethroid</b> + Flufenoxuron IGR + Dust
<b>TREATMENT 3</b> (after 4 weeks, or depending on temperature and therefore egg hatch)	<b>Residual Carbamate</b> + Pyriproxyfen IGR + Dust

This regime ensures that the maximum number of insecticide groups and therefore modes of action are used against the bed bug. Modes of action include acetylcholine esterase inhibitors, sodium channel modulators, and insect growth regulators. Even the type of insect growth regulator is rotated, using a juvenile hormone mimic followed by a chitin synthesis inhibitor. ULV based flushing agents are also available, which contain a synergist, piperonyl butoxide, which inhibits the insect detoxification mechanism. ULV flushing agents can excite bed bugs and flush them into other areas so they should be used with caution. A flushing agent in aerosol formulation is recommended as an essential part of the inspection process. This regime also utilises a number of different formulations, including microencapsulated, dust, suspension concentrates and wettable powder insecticides.

## ALTERNATIVE CONTROL

### Non-chemical control – Vacuuming

- Vacuum general area of the floor and use crack and crevice extension at wall / floor junction.
- Vacuum mattresses and other furniture, removing cushions and turning furniture upside down.
- Vacuum cleaners with HEPA filters are recommended to prevent the spread of potentially irritating debris through the exhaust.
- Dispose of the vacuum cleaner contents in a sealed bag as soon as possible, preferably by incineration. Insecticide dust can also be applied to the contents.
- Inspect all other potential bed bug refugia and vacuum if insects are present.
- Vacuum cleaners themselves could spread infestations. They should be 'treated' by soaking plastic parts in hot water. When not in use, the vacuum cleaner should be stored in a sealed bag.
- Vacuuming will not remove all bed bug eggs, so subsequent insecticide application is essential.

## LAUNDERING PROCEDURES FOR BED BUG CONTROL

The following table is an extract from work by Richard Taylor at the University of Sheffield.

Treatment Method	Temperature & Duration	Control Level
Washing machine (non-biological detergent) 3.2kg	Cool – 30°C – 30 minute wash	Did not kill Egg stages
	Hot – 60°C – 30 minute wash	Killed all life stages
Tumble Dry 3.2kg	Cool dry – 30 minutes	Did not kill all stages
	Hot dry – 30 minutes – 40/45°C	Killed all stages
Cold Soak 3.2kg	Cold water – 30 minutes	Killed adults/nymphs only
	Cold soak – 24 hours	Killed adults/nymphs only
Dry cleaning (perchloroethylene)		Killed all life stages
Freezing 2.5kg	2 hours at -17°C (8 hours to get clothes and items to -17°C, takes total 10 hours of treatment)	Killed all life stages

## EXTREME TEMPERATURE TREATMENTS

There are commercially available extreme heat and cold treatments that can be used to treat bed bug infestations. These techniques certainly have their uses, especially where pesticide use may be undesirable or resistance is suspected. Tests have shown that bed bugs can be controlled successfully using extreme cold treatments, backed up with vacuuming. It must be remembered, however, that extreme temperature treatments offer no residual effect.

## STEAM TREATMENT

This technique can be used successfully, depending on the quality of the steam. This method can be particularly useful as it kills all life – stages of the bed bug, including the egg. The quality of steam is important. 'Dry' steam with less than 5% humidity, at 94°C, applied at a high pressure is recommended.

## POST-TREATMENT ADVICE AND RISK MINIMISATION MEASURES

- Repair any loose wallpaper.
- Repair any sources of moisture.
- After treatment, re-attach the cloth cover to the bottom of the divan base.
- After treatment, seal cracks and crevices.
- Covering the mattress with a plastic or allergy-proof cover may help prevent re-infestation by reducing the harbourages. Some covers will trap bed bugs, causing them to die of starvation.

## Other UK species

### ***Cimex columbarius*, the pigeon bug.**

It is very similar in habits and appearance to the common bed bug, *Cimex lectularius*. Control is as for *Cimex lectularius*, although removal of pigeons and their roosting material is the key to control.

### ***Cimex pipistrelli*, a blood-feeding bug associated with noctule and serotine bats.**

These bugs will feed on birds and man in the absence of a more suitable host.

This species was originally found in southern parts of the UK and Ireland, but recent records show a more northerly distribution.

The relevant Statutory Nature Conservancy Organisation should be contacted in view of the fact that bats were or are present.

### ***Oeciacus hirundinis*, Martin bug.**

These insects resemble bed bugs and are commonly mistaken for them. They are blood feeders, parasitising birds, particularly martins and swallows although sparrows and woodpeckers may also be attacked. When young birds vacate the nest the martin bugs will leave and search for other warm-blooded creatures such as human beings. Control is as for *Cimex lectularius* and removal of birds' nests is the key to control.

### **RECOMMENDED TRAINING COURSES FOR PCOs**

Advanced bed bug control training courses.

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Killgerm Chemicals Limited, PO Box 2, Ossett, West Yorkshire, WF5 9NA  
**Tel:** 01924 268400    **Fax:** 01924 267874    **Email:** info@killgerm.com

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