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Bed Bugs Limited

Prepared by

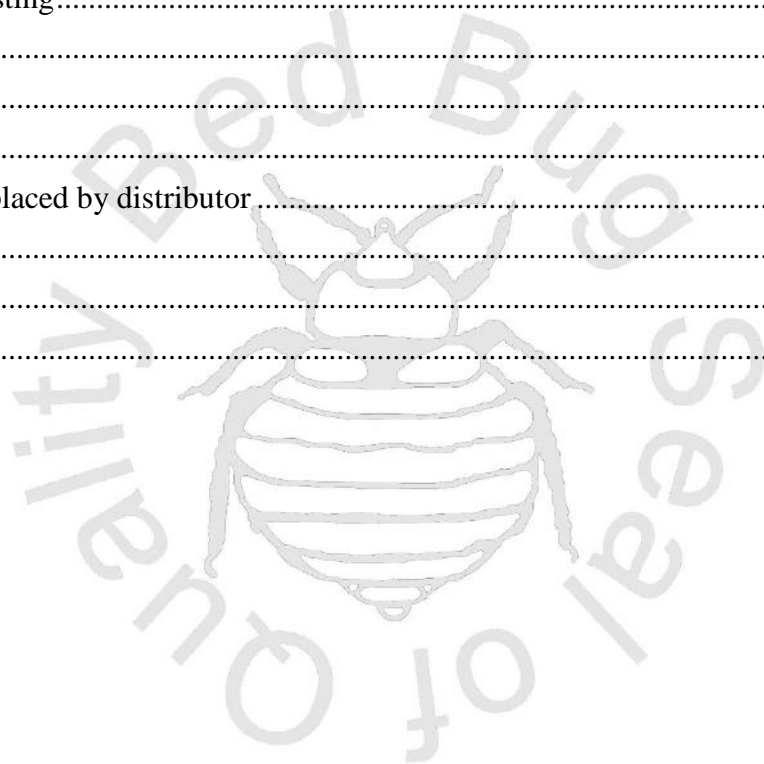
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Testing report for the BBD100 bedbug detector from TDS

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About bedbugs

Bedbugs are blood feeding parasites that preferentially feed on humans. They are a persistent pest and have developed a number of highly evolved abilities to remain close to humans.

They are a pest of exposure and only arrive in your home if you have come into contact with them external to the property or if an adjoining property has a significant infestation.



Close up of an adult bedbug, when fed they become oval in shape but are usually only seen when they are thin and flat.



Close up a juvenile bedbug, the characteristic dark brown colour develops as the bedbug matures and younger samples may appear translucent.



Close up a nesting area showing many of the classic signs of bedbugs, live samples, cast skins and faecal trace signs.



Close up of a bed slat illustrating a build-up of faecal traces and some egg casings close to the joint in the wood.

Bedbugs have been documented as pests since the 17th century although they have been around for much longer and most likely followed man out of the caves millennia ago. Bedbugs were common in the UK prior to World War II, after which time widespread use of synthetic insecticides such as DDT and public education greatly

reduced their numbers, at one stage though in the 1930's 30% of all homes in London were infested.

In the past decade, bedbugs have begun making a comeback across the world, although they are not considered to be a major pest or health hazard they can be highly unpleasant to live with and can cause a severe lack of sleep. International travel and commerce are thought to facilitate the spread because eggs, young, and adult bed bugs are readily transported in luggage, clothing, bedding, and furniture. Bedbugs can infest airplanes, ships, trains, and buses, recent cases that we have worked on have been traced back to travel where the source was identified to be the return journey rather than an infested room.

Bedbugs are most frequently found in dwellings with a high rate of occupant turnover, such as hotels, motels, hostels, dormitories, shelters, apartment complexes, tenements, and prisons. Such infestations usually are not a reflection of poor hygiene or bad housekeeping but that a previous occupant had come into contact with them at some stage.

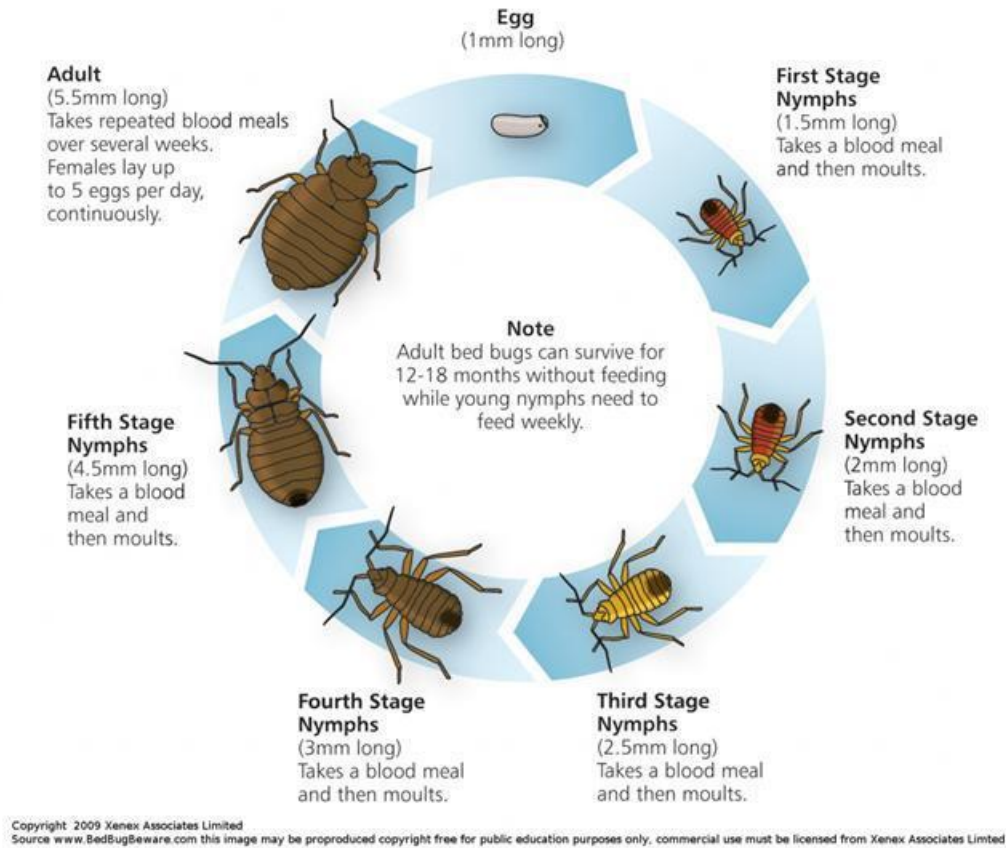
Adult bedbugs are brown to reddish-brown, oval-shaped, flattened, and about 3mm to 5mm long. Their flat shape enables them to readily hide in cracks and crevices. In some cases colonies have been found in places where it is difficult to insert a sheet of paper.

Life Cycle

Female bedbugs lay from one to twelve eggs per day, and the eggs are deposited on rough surfaces or in crack and crevices. The eggs are coated with a sticky substance so they adhere to the substrate. Eggs hatch in around 10 days, and nymphs can immediately begin to feed. They require a blood meal in order to molt and develop into the next stage. Bedbugs reach maturity after five molts. Developmental time (egg to adult) is affected by temperature and takes about 21 days at 30°C to 120 days at 18°C. The nymphal period is greatly prolonged when food is scarce. The adult's lifespan may encompass 12-18 months and they are known to be able to survive for 12 months between feeds although if a source of food is present they will always be active.

Life Cycle of the Bed Bug

Cimex lectularius



Habits

Bedbugs are fast moving insects that tend to be most active at night when we rest; they feed on blood using a piercing mouth part the entry of which is often unnoticed. Nymphs may become engorged with blood within three minutes, whereas a full-grown bedbug usually feeds for ten to fifteen minutes. They then crawl away to a hiding place to digest the meal; a full meal may take 3 or 4 days to digest.

Bedbugs hide during the day in dark protected sites, they prefer fabric, wood, and paper surfaces. They usually occur in fairly close proximity to the host, although they can travel great distances if needed. Bedbugs initially can be found about tufts, seams, and folds of mattresses, later spreading to crevices in the bedstead. In heavier infestations, they also may occupy hiding places further from the bed. They may hide in window and door frames, electrical boxes, floor cracks, baseboards, furniture, and under the tack board of wall-to-wall carpeting. Bedbugs often crawl upward to hide in pictures, wall hangings, drapery pleats, loosened wallpaper, cracks in plaster, and ceiling mouldings.

Injury

The bite is painless at the time but can cause the skin to become irritated and inflamed. Individuals differ greatly in both the extent and timing of their response to a bite. A small, hard, swollen, white welt may develop at the site of each bite which can occur in rows or batches of three or four but also in single reactions. This is often accompanied by severe itching that lasts for several hours to days, in rare cases an allergic reaction may follow, in such cases seek medical attention immediately. The morphology of bites is highly variable and it is almost impossible to diagnose on bites alone.

It is believed that 1 in 10 people show no signs of biting, often leading to the myth that they only attack certain people and about 60% of people do not appear to show signs at the start of an infestation. Cases of extreme reaction seem to be on the increase and affect as many as 2 in 10 people. Given the extent of some of the documented infestation in commercial properties it is clear that waiting for bites to indicate an issue is too unreliable and results in infestations which progress beyond simple and fast control.

Confirming signs

There are only three easily confirmed signs of bedbugs, these are:

- Live samples – although cryptic in nature and small at the nymphal stage they are detectable by those with good eye sight.
- Cast Skins – due to the incomplete metamorphic life cycle of bedbugs they must shed skins between blood meals to develop. This can be a good indication of how long an infestation is present.
- Faecal traces – as bedbugs must defecate after a blood meal and often just before entering a refugia these are the most indicative sign of their presence and can be a good indicator of their locations.

The following are considered to be non-confirming signs:

- Bites – this is because not everyone initially responds to the bites of bedbugs, this fact explains why a hotel can have an undetected infestation for so long and why screening for early detection is such an essential step in an integrated bedbug management systems.
- Blood spots on sheets – an equally variable sign not only due to the different types of blood spots but also due to the fact that not everyone continues to bleed from the puncture wound.

Prevention

In the case of domestic settings prevention can only be achieved through avoidance of this pest. As a pest of exposure bedbugs must always be brought into the home

through an introduction event or increasingly through adjoining walls from a neighbouring property. Sources of bedbugs in domestic settings have been traced back to:

- Work locations
- Hotel stays
- Hospital stays
- Public transport
- Second hand items
- Delivered with new items

Domestic prevention is only possible through public education and increased awareness of the need for early detection and avoidance. Although this is a slow process in today's fast media culture it was the only solution in the past and remains an extensively untapped opportunity.

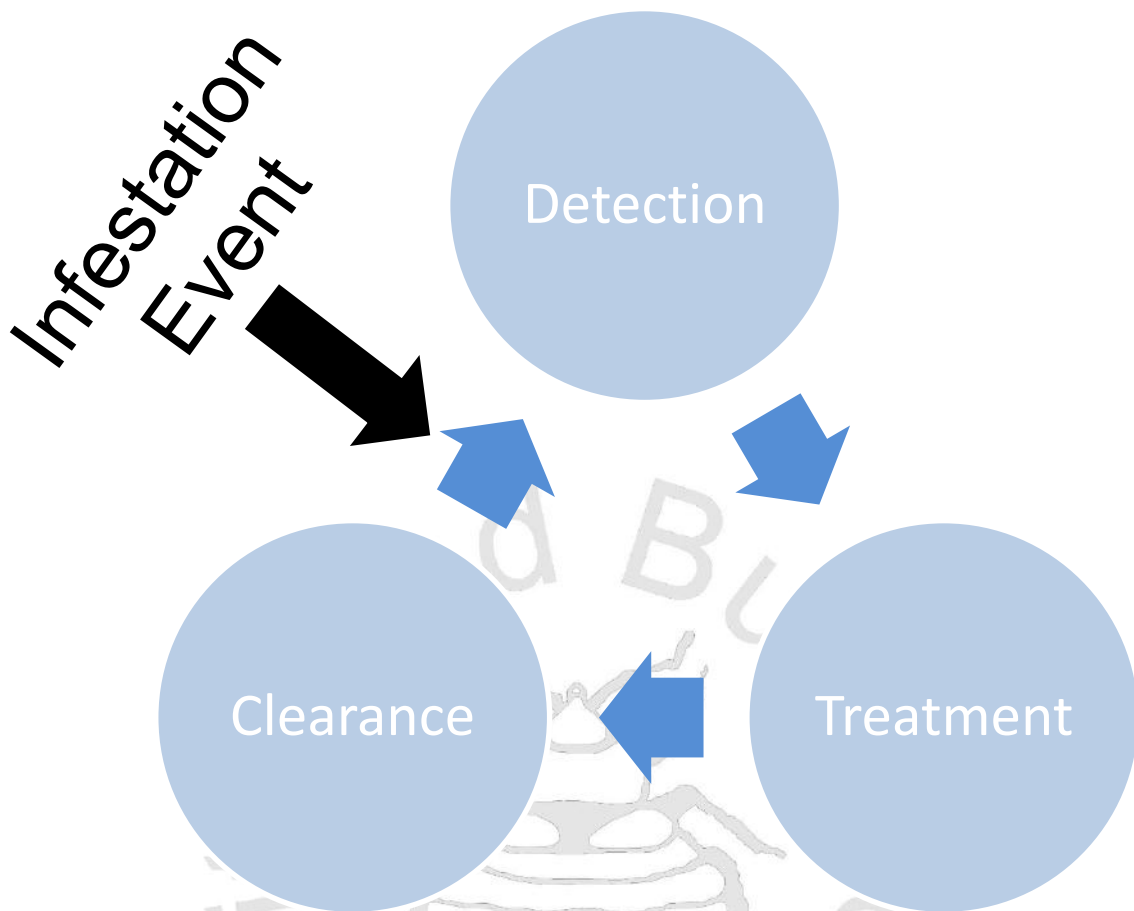
In commercial settings prevention is often not possible beyond regulation and monitoring of the supply chain. However the main source will always be guests and staff who may not even be aware of the unwanted problem they leave behind.

It is therefore even more essential to seek solutions to both early detection and efficient treatment with minimal downtime to organisations. Current solutions often have far reaching costs beyond the treatment processes which can have a significant impact on organisations efficiency.

Do not bring infested items into the home. It is important to carefully inspect clothing and baggage of travellers, being on the lookout for bedbugs and their tell-tale faecal spots. Also, inspect all second-hand beds, bedding, and furniture. Identifying the source is one of the key aspects to controlling an infestation. Unless the source is excluded from the property the stock of bed bugs will be continually replenished and the life cycle will continue.

If adjoining neighbours are suspected then communication of the issue sooner rather than later is essential so that the source of the infestation can be dealt with.

The infestation cycle



The infestation cycle of bedbugs encompasses three distinct phases:

- Detection – the first stage of the control cycle is to identify and confirm the issue. Although there are multiple approaches to detection the key to an effective system is cost and operational efficiency. Regardless of what method is used the aim should always be to detect the infestation within the first 30 days when it is relatively contained and less likely to have spread through to other rooms. We have successfully illustrated in client sites that driving this process forward always results in a lower impact of the infestation where it can be resolved in a few hours.
- Treatment – although this is the part of the cycle which we tend to focus on the most it is in fact clearly the wrong stage for initial focus. The extent of an infestation and therefore the appropriate methods to apply is very much dictated by the extent and duration of the infestation.
- Clearance – in essence a control stage to ensure that the treatment has been effective and that all bedbugs have been eradicated.

The infestation event cannot be modelled or predicted, the only control we can exercise over it is to reduce the period of time between the infestation event and the detection and subsequent control phases of an infestation. The shorter the time

between the infestation event and the detection of an infestation the faster the issue can be resolved.

Review of BBD100 technology

The BBD-100 from TDS is the first in a class of planned handheld bedbug detectors which sample the air and detect the “off gases” of bedbugs. In theory a handheld detector would be of great value to the pest control industry, hospitality and homeowners.

The device is presented as a small well-made device about the size of two iPhones joined face to face complete with belt holster carry case. First impressions is of a unit which is well made and built to a high production quality.

Results of testing

Test 1

The detector was activated, allowed to calibrate and then placed on the mesh topped Mason jar containing 300 - 500 bedbugs.

Sadly the detector failed to register even a single bar on its lights scaled 1 – 5

Test 1.5

The detector was activated, allowed to calibrate and then placed inside the Mason jar about 2.5 inches away from 300 - 500 bedbugs.

Sadly the detector failed to register even a single bar on its lights scaled 1 – 5

Test 2

Probe placed 1mm away from a live bedbug

In case the unit was faulty I requested a replacement from the UK distributor

An image of this test is included for confirmation.



Picture illustrating BBD100 failing to detect 3 bedbugs despite being less than 1 mm away from the live samples

Unit replaced by distributor

Test 3

Probed a small cluster of 6 – 7 bedbugs on the edge of a putter lid with the sampling probe only a few millimetres from the samples.

Sadly the detector failed to register even a single bar on its lights scaled 1 – 5

Test 4

As a final test I decided to replicates what can be seen on the manufacturer's websites here:

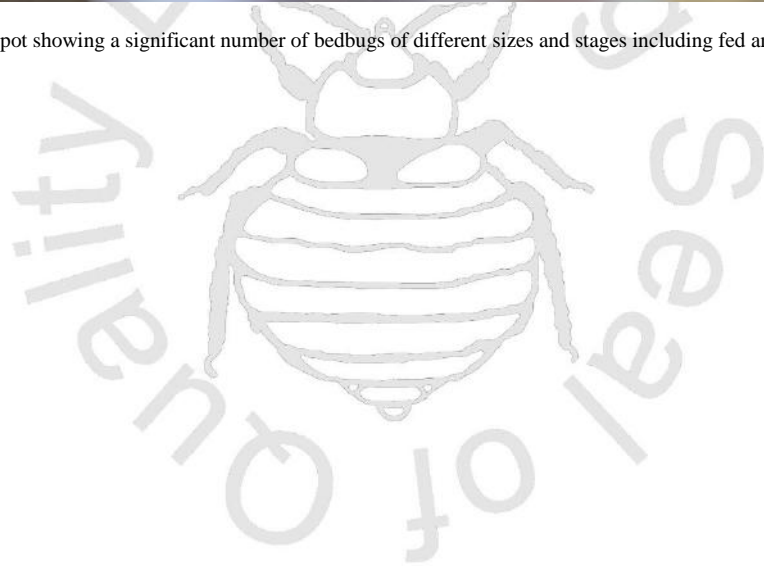
<http://www.findbedbugsnow.com/bbd100.cfm>

The main colony of bedbugs was fed and placed in a similar style container, the number of bedbugs can be seen in the image below along with a picture of the unit sampling the container.

The samples were left for 5 minutes before sampling occurred to allow for any detectable gases to build up.



Sample pot showing a significant number of bedbugs of different sizes and stages including fed and unfed.





Definitive test showing a failure to detect even the significant number of bedbugs shown in the picture above.

Conclusions

The system clearly fails to detect bedbugs even when they are in significant numbers. I suspect this is due to the nonspecific detection criteria which are clearly based on CO2 rather than pheromone or a specific “off gas” unique to bedbugs.

At this stage the system could not be endorsed as efficacious for the detection of bedbugs and its continued sale will ultimately reflect badly on those involved.

We again call upon all professional bodies to fix a set of testing criteria for bedbug products which is clear from both the supply and development processes to ensure that products are fit for both sale and purpose. Without introducing clear standards the reputation of the pest industry will continue to be tarnished by these “me to” and poorly developed products.