Pest control technical note

health

Bed bugs

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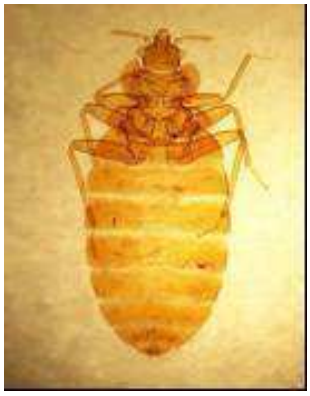
Bed bugs are small wingless insects that feed on human blood. They belong to the family Cimicidae within the order Hemiptera. The insect's name is derived from its chosen habitat: human beds. Places where bed bugs are often found include houses, hostels, bedrooms, beds and other places of little movement, such as the cinema. Although unable to fly, bed bugs are fast movers and are quick to escape once exposed to light.



Adult bed bugs have a flat oval-shaped body, which is light brown in colour and may become red and engorged after a blood meal. Ranging in length from 1–4.5 millimetres, fully-grown adults reach a similar size to an apple seed. They have six legs, long antennae and large mandibles (or mouth parts), which can impale human skin.

There are two main species of bed bugs found in Australia.

Cimex lectularius or 'common bed bug' is the species which adapts best to temperate climates and is the most widespread species across the globe.

C. hemipterus or tropical bed bug is usually confined to tropical regions, preferring high humidity and temperature.

While similar, these species of bed bug can be identified by the first section of their thorax, found between the head and abdomen. The first section of the thorax of the common bed bug is much wider and flatter than that of the tropical bed bug. The tropical species usually occur mainly north of the New South Wales–Queensland border and the common species are found to the south, with some overlap between the borders.

Life cycle

In Australian conditions adult bed bugs can live for up to six months, dependant on feeding. Females lay two or three white eggs per day and up to 3,500 over the course of their lifespan. Eggs usually hatch within five or ten days under warm conditions, but can lie dormant for longer periods. Newly hatched nymphs look very similar to adults but are smaller, translucent and white in colour. Nymphs are often more numerous than adults in sites of infestation.

A bed bug goes through five moults (a shedding of the skin) before reaching maturity. Younger nymphal stages have a white appearance when unfed and become darker as feeding increases. A blood meal is required for each moult. It normally takes around 21 days (at 22 °C) for nymphs to reach the adult stage. This process may take significantly longer if no food is available or if there are cooler conditions.

Bed bugs are a mainly nocturnal insect, resting during the day and completing most of their feeding at night. Warmth and presence of carbon dioxide (which humans breathe out) attracts these insects. Bed bugs will feed every five to ten days but may survive for several months without a blood feed. They are equipped with two hollow tubes to pierce the skin and aid in feeding. One of these tubes is used to withdraw blood from the sleeping victim

while the other injects anticoagulants and anaesthetic into the host.

The anaesthetic can make the bite painless, which means that a sleeping victim may be unaware of the bite. The anticoagulant stops clotting, making the blood easier to withdraw. This also means that a person may continue to bleed from the bite site, resulting in tell-tale spots of blood on their sheets. Bed bugs may take up to 10 minutes to feed. Once they have fed, bed bugs are able to quietly rest themselves under various materials and lie completely still for long periods. This can make detection difficult.

Symptoms of bed bug bites

Different people have different reactions to the bites of bed bugs, depending on a number of factors. Some people have little or no reaction to the bite. In others the bite site can become red and intensely itchy. This can occur during the course of a night or may take up to 14 days to develop. If the host experiences an allergic reaction from the injected anticoagulants, large wheals, welts and swelling can occur on the limbs that have been bitten. The red wheals may range from 2–5 centimetres in width with inflammation common. Anaphylactic shock can occur after a bite in individuals who are highly allergic, although this is very rare.

Discomfort and loss of sleep are common psychological effects of bed bug infestation. Bites may be found on a variety of places on the body. Another characteristic of bed bugs is the occasional presence of bites in orderly rows, unlike the random pattern of mosquitoes. These rows are caused when bed bugs are disturbed during feeding and have to pierce the skin to feed again, or when bed bugs have difficulty locating a suitable vein.

Bed bugs mainly feed on humans but will also feed on other mammals and poultry. Although they may carry diseases such as hepatitis they are not known to transfer them to other individuals.

Photo credit: Piotr Naskrecki

Why are they becoming a problem?

Recent times have seen an increase in the number of bed bug infestations in Victoria. Bed bugs are common all over the world, but until recently were only found in Australia in small numbers. Bed bug infestations have increased substantially both worldwide and in Victoria over the last ten years. The main reason for the increase is thought to be the pests' increased insecticide resistance; modern bed bugs are highly resilient to many commonly used insecticides. Another contributing factor is the increase in world travel, with bed bugs being spread internationally in luggage, shoes and clothing. Once acquired by travellers, the hitchhiking bed bugs can then be transported to new homes, developing new infestations. Many hostels worldwide have now banned the use of travellers' own sleeping linen in shared accommodation as a safety precaution against this pest.

Another reason for the increasing prominence of bed bugs is thought to be changes in the pest control industry. Many of the pesticides once readily used to kill bed bugs have been banned due to their wider health or environmental impacts. These pesticides were more effective in controlling bed bugs due to their high insecticidal nature.

Detection

In early infestations, bed bugs are usually found around the seams, beading and folds of mattresses, sleeping bags and sheets. Later, as the infestation spreads, the bugs move to any tiny crevices, which may be in bed heads, skirting boards, cracks in plaster and bedroom furniture. Because of their colour, adult bed bugs can easily be spotted with the naked eye on white sheets and bedding, but are very difficult to see on brown wooden floors and other dark surfaces. The small size of the young nymphal stage bed bugs makes them difficult to observe on any surface.

Heavily used hiding places are evident by black or brown spots of dried blood excrement or 'spotting'. There may also be an offensive sweet sticky odour when bed bugs are numerous. This odour, sometimes described as 'buggy', is similar to the odour when a stink bug is squashed. White eggs, white egg cases and moulted skin shells may also be found near these places, as well as living bed bugs.

Bed bugs use pheromones to communicate. The release of alarm pheromones can make them very difficult to treat as bed bugs become alert and quickly vacate the area being treated if it has not been properly quarantined.

Bed bugs may also spread into a new residence by travelling between multi-unit housing such as condominiums, dormitories, and apartment buildings. Once they find a suitable host, bed bugs will feed and are likely to harbour in close proximity to the victim. In this case new locations can quickly become infested with bed bugs in a short amount of time.

How to treat them

The Australian pest management industry, along with health researchers, developed a comprehensive Code of Practice for Control of Bed Bugs. This can be downloaded free from: www.bedbug.org.au

When treating an area for bed bugs, complete eradication is unlikely to be achieved with a single treatment. Sprays may kill the bed bugs but they are largely ineffective against the eggs. Follow up inspections are always required and further treatments often necessary.

The survival of bed bug eggs is also an issue. It is not uncommon for the live bed bugs in an infestation to be completely eradicated during an effective treatment cycle, only to have the remaining or surviving eggs hatch and populate the location once again. The eggs can also have an incubation period of up to two weeks and may be deposited in hidden areas that are difficult to treat.

This stubborn tendency of bed bug infestations is made more problematic due to the smaller size of the newly re-emerged bed bug nymph. Once an infestation is detected, all adjoining rooms need to be inspected and treated.

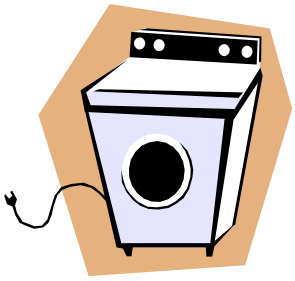
Non-chemical control

There are several prominent methods of non-chemical control.

- Maintaining an appropriate cleaning regimen, such as regular vacuuming behind beds, ensures **hygiene** upkeep and limits the chances of bed bug infestation.

Remember to quarantine all equipment and clothing that has come in contact with a bed bug infected area.

- Bed bugs can also be **physically removed** using adhesive tape (if insect numbers are very small), or by vacuuming. Vacuuming is recommended before chemical treatment as it removes all dust and debris from the site of the infestation, making it easier for the following chemical control to penetrate and be effective. Particular attention should be paid to the edges of the room, near furniture and around fixtures. The vacuum bag should be placed in a sealed bag and incinerated, or discarded appropriately immediately after cleaning. Care must be taken not to unintentionally spread the eggs by the use of stiff brushes.
- **Using heat** is another excellent way of killing bed bugs in bedding and sheets. Bed bugs will die within one hour when exposed to temperatures over 45 °C, or immediately at temperatures of 60 °C or higher. Gradual and slow heating of the infected area will result in the bugs migrating away from the heat source, potentially causing them to infest new areas. Using steam has the advantage of killing the bug in all stages of its life cycle. Steam vapour may be used on all soft and hard surfaces, especially on seams and in little crevices. Washing in water above 60 ºC (to ensure every bug stage will be killed) and drying infested linen in a dryer is an effective method of killing bed bugs. It is recommended that clothes be placed on the hot setting and dried for at least 30 minutes.



- Using **cold**, in particular rapid freezing, can also be fatal to bed bugs. Placing smaller items in the freezer overnight is an effective control method. Leave items in the freezer for 10 hours for every 2.5 kilograms of dry linen weight.

Chemical control

A licensed pest control operator must only apply pesticides that are either currently registered or permitted for use by the Australian Pesticides and Veterinary Medicines Authority (APVMA) for the control of bed bugs. Active ingredients currently registered for the treatment of bed bugs include bendiocarb, various synthetic pyrethroids and diazinon. The pesticide applied will be selected on its usage patterns. For example, dust is excellent at penetrating voids and cracks where bed bugs reside, but would not be as affective in a location where it can be dispersed by traffic and vacuuming.

Pesticide sprays are also used for treatment. A product with a residual formulation is used and any bed bug risk areas are targeted. It is important to ensure accurate and direct application to harbourage areas such as beading on mattresses, cracks and crevices in furniture and flooring. If the operator completes simple space spraying the fine droplets can excite the bugs. This in turn can cause them to excrete alert pheromones, and quickly disperse.

It is important to consult the pesticide label before use as some organophosphates and carbamates cannot be applied to mattresses. At the end of treatment, rooms should be well ventilated and re-entry periods observed. A follow up treatment visit should be conducted in about a week, to allow for hatching of eggs, and pesticide re-applied where necessary. The clients should be advised to limit the amount of cleaning so that the residual pesticide is not removed. Sprays may kill the bed bugs but they are ineffective on the eggs.

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