

Managing Bed Bugs



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Human bed bugs are found worldwide and spread through human travel. Over the past decade bed bug infestations have significantly increased in the U.S. and other parts of the world. Experts speculate that increased travel, changes in insecticide use patterns, and insecticide resistance may be responsible for this upsurge in bed bug numbers.

While bed bug control can be difficult, effective new products are under development and pest control professionals are developing new techniques to deal with these pests.

What do they look like?

Bed bugs are reddish-brown, wingless, and very flat. ¹ Adults are about $\frac{1}{4}$ to $\frac{3}{8}$ inch long. Immature stages will be light-colored prior to feeding. After a blood meal, bed bugs have a distended body and can look like a completely different insect. ²

Human bed bugs look nearly identical to other blood-feeding bugs, such as those that feed on bats and birds. It is important to make sure you are dealing with human bed bugs because a bird bug or bat bug infestation may require removal of bird nesting sites or bat colonies. Consult your local extension educator or professional entomologist to verify the species in question.



What are their habits?

Bed bugs feed on blood as their only source of nutrition. An immature bed bug feeds once during each of its five developmental stages. After feeding, the nymph takes five to seven days to digest its blood meal. It then sheds its outer skin, a process called molting, and is again ready to feed. Female bed bugs lay three to five eggs each day and can live for two months or more. A breeding female will need periodic blood meals over her adult lifetime to continue to produce eggs.

Time of development depends on host availability and temperature. Because bed bugs only feed on blood, availability of humans or other warm-blooded hosts determines how quickly bed bug populations will increase. If bed bugs find a blood meal any time they are hungry and the home is at room temperature, they can grow from egg to adult in five to six weeks.

As bed bugs digest their blood meal, they excrete drops of black feces, which often can be found on bedding and mattresses and associated with hiding places. Bed bugs also produce a chemical substance in their droppings called an aggregation pheromone, which attracts other bed bugs. As a result, bed bugs are often found in groups.

Bed bug eggs are light-colored and smaller than the size of a pinhead. These eggs develop red eyespots prior to hatching. ³ At room temperature, eggs hatch in about five days. ⁴

Feeding and bites

Bed bugs find their hosts at night by sensing carbon dioxide and body heat. The human bed bug, *Cimex lectularius*, prefers humans, but will feed on other warm-blooded animals, including pets. During the day they hide in cracks and crevices near the bed or in areas where people sleep. At night, bed bugs leave their hidden retreats to feed and return to hiding places before dawn. Some bed bugs, especially adult females, may spend the day farther away from the bed and away from groups of males and immature bed bugs. It is these isolated, mated females that crawl into the luggage of travelers and can be missed by insecticide applications.

There is no “typical” bed bug bite. Bed bugs will feed on any part of the body, although bites through nightwear are unlikely. Each person reacts to bed bug bites in a different way and some people are more sensitive

to bites than others. Responses range from small red spots that may or may not itch to itchy inflamed areas to large watery blisters and even hive-like reactions. Physicians may not always recognize bed bug bites because sometimes they look like other skin disorders or allergies.



Delayed reactions to bed bug bites are common. Symptoms may appear from one to two days after a bite to more than three weeks later. People who react strongly to the bites of other insects may be more sensitive to bed bug bites. About 20-25 percent of individuals are asymptomatic and show no sign of being bitten. When different people in the same family (or roommates) have different reactions, the situation can be confusing, delaying the identification of an infestation.

Where do bed bugs come from?

Bed bugs do not just spontaneously appear in a home or apartment. They cannot fly so usually people accidentally move them from place to place.

The most common ways bed bug infestations get started

- Someone moves into an infested home or apartment. This guarantees an instant infestation.
- Travelers bring bed bugs home from infested hotels or motels in their luggage. It only takes one mated female to start an infestation.
- Bed bugs being carried into the home on infested (used or new) furniture or mattresses.
- Bed bugs hitching a ride from an infested dwelling to another location by clinging to clothing or other objects. (Be careful if you visit an infested home or apartment.)
- Family members or other visitors who have recently been exposed to bed bugs in infested dwellings and spend the night in your home.

How long can bed bugs live without a blood meal?

If bedbugs cannot feed, they will die of dehydration because they lack other means of obtaining fluids. Immature bed bugs dry up more rapidly than adults. This is particularly true for first stage bed bugs, which are very small and may have to travel comparatively long distances to feed.

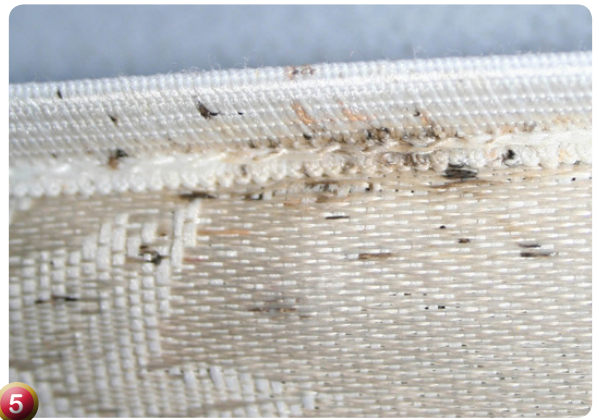
Research at Virginia Tech University has shown that at 78°F, on average, an unfed adult bed bug can live about 70 days before succumbing to dehydration. The word *average* implies some individuals will die sooner than 70 days, while others will live longer. In homes and apartments, it is possible that unfed bed bugs could live five or six months, especially when temperatures are cooler and the relative humidity is high.

In addition to homes, apartments, and hotels, bed bugs also have been found in office buildings, schools, and other places where people work. However, infestations in workplace locations (where people do not sleep) are generally scattered so, while possible, the likelihood of acquiring bed bugs is relatively low. Once established inside apartments or hotel rooms, bed bugs readily move to other rooms as their numbers increase. In multiple-unit housing, such as hotels, motels, and apartments, bed bugs may travel through wall voids or across the hallways to reach neighboring units.

How to find bed bugs

Bed bugs are flat insects that live in cracks and crevices around the bed. Studies have shown that most bed bugs inhabit the mattress and foundation/box springs, but some may be found in locations away from the bed. Among the more unusual locations where bed bugs have been found are in the pinch-pleats of draperies, curtain rods, popcorn ceilings, clock radios, and even in cell phones. If someone regularly sleeps on a sofa or in a recliner, this furniture also may become infested.

To detect bedbugs, examine the bed and foundation/box springs. Remove all the bedding and examine it carefully for bed bugs and their tarry black fecal spots or smears. Pay special attention to seams and fitted corners of sheets and mattress pads. Carefully examine the cording of mattress edges. ⁵ The wood framing of the box springs provides many hiding places for bed bugs. ⁶ Turn the box spring over and remove the gauze-like dust cover. Carefully inspect the cracks of wood framing where wood pieces come together. Peel back the fabric where it is stapled to the wooden frame and examine it closely. Groups of bed bugs often like to hide in tight places near staples. ⁷



Sofas and recliners are difficult to inspect and signs of bed bugs are not easy to see, especially if the fabric is dark. Separate folds and examine seams where sections of fabric are sewn together. Turn the furniture over and check the underside. Separate the dust cover from the frame and check where wood and fabric produce tight spaces.

Even if bed bugs are found, you should continue your search in other locations near the bed. Remove pictures from the wall and

check their backs. Move the bed away from the wall and look along the edge of carpet, next to the baseboard. Remove electrical receptacle and light switch covers. Don't forget the closet where bed bugs may be hiding attached to clothing.

If your inspections are negative and no bugs are found, insecticides won't be needed, eliminating the cost of treatments.

Traps

Several commercial bed bug traps use CO₂ and/or other attractants to capture bed bugs. Two of these are the NightWatch™ (Biosensory, Inc.) and the CDC 3000™ (Cimex Science). Research indicates these traps are effective, but not any more than the less expensive do-it-yourself traps.

A small wall-mounted monitor, Verifi™, has been developed. It uses CO₂ and pheromones to attract bed bugs. Currently, it is only available through certified pest control professionals.

DIY traps

A do-it-yourself (DIY) bed bug trap is made from simple items costing about \$15. This trap is not meant to be a control device, but it is helpful in detecting bed bugs and removing those not killed by other control measures. This DIY trap uses dry ice as a source of carbon dioxide. Be careful when handling dry ice as it can burn skin. Always keep it away from children and pets.

Bed bug-sniffing dogs

Well-trained bed bug-sniffing dogs can be extraordinarily accurate at finding bed bugs. Entomology researchers at the University of Florida reported that a well-trained dog can detect bed bugs with 96 percent accuracy. There are several situations when a bed bug-sniffing dog is useful. Dogs are especially good at finding very small infestations, even one bug. This single bug would be extremely difficult to spot visually.

The disadvantage of using a dog

The primary disadvantage of using a dog is the expense. If a person knows that bed bugs are present, it makes little sense to hire a dog. Hiring a bed bug-sniffing dog may be helpful in the following situations:

- If it is important to know if a bed bug infestation has spread to other rooms in the house or whether a specific piece of furniture needs to be treated or discarded.
- If an apartment has bed bugs and it is important to know if bed bugs have moved into neighboring units.
- If a person wants to make sure the bed bug infestation has been eradicated. Many times, you may have to wait 30 days following an insecticide treatment before a dog inspection. Be sure to mention all prior insecticide treatments (for any reason) when setting up an appointment with the dog's handler.
- When isolated bed bug infestations are suspected in office buildings, hospitals, schools, or movie theaters.
- To inspect vacant apartments prior to the occupancy of new tenants.
- For routine inspection of hotel and motel rooms.

Recent research indicates many dogs do not perform as well in the field as in controlled studies. We recommend the handler or other trained individual doublecheck all positive "hits" to verify bed bugs are present before any treatment begins.

Managing bed bugs

Sanitation is one of the keys to successful bed bug control. Simplify infested rooms by removing clutter and any unnecessary items that could serve as bed bug hiding places. Reduce furnishings to the barest necessities.

When removing items from infested rooms, place in large garbage bags or wrap them in plastic to ensure bed bugs are not inadvertently moved to other locations. Eliminate unwanted items by moving them outside to a garbage can or dumpster. Label or deface these items so other people will not pick them up and take them home.

Dismantle the bed and other bedroom furniture. Use a vacuum to remove bed bugs from their hiding places. The box springs are especially susceptible to infestation. Vacuum the area where the carpet meets the wall, especially near the head of the bed. After vacuuming, immediately take the vacuum cleaner bag out to the trash. Since bed bug eggs are sticky and not easily removed by vacuuming, use a stiff plastic brush to scrub infested areas to detach or at least damage the eggs.

Discarding bed bug-infested mattresses is an option suggested by some pest control companies. If the mattress and foundation are in poor condition, throwing them away makes sense. However, if the mattress is in good condition, you can encase the mattress in a zippered cover that is tightly woven to prevent the mattress from harboring bed bugs. These mattress covers are available for beds of all sizes. Keep the cover on the mattress for at least a year to ensure all the bugs are dead. You must also encase the box springs. If you can't afford to encase both mattress and springs, encasing the box springs is more important.

The sides of many mattresses have metal grommets that are part of the handle assemblies. ⁸ Bed bugs can squeeze through the grommet holes and live inside the mattress. The insides of mattresses cannot be treated with insecticides. These mattresses must either be discarded or encased.



All washable items associated with infested areas should be laundered and dried in a hot dryer. Items that cannot be laundered can be dried in a hot dryer for 30 minutes. It is best to dry clean woolen blankets, and then place them in sealed garbage bags until the infestation is eradicated. Pillows also can be placed in a hot dryer. After laundering, all items should be placed in new garbage bags and sealed to prevent bed bugs from entering. Place washed items in an area known to be free of bed bugs.

While non-chemical methods (vacuuming, steaming, laundering, mattress encasement) are essential components of a successful bed bug control program, it is unlikely these methods alone will eliminate an infestation. In general, insecticides will still need to be applied to bed bug-infested areas. Because insecticide treatments pose a potential health risk in sleeping areas, it is important to select products that are labeled for use in bedrooms.

Chemical treatments

All bed bug hiding places must be identified and treated. Because finding and treating all these areas is difficult, we recommend hiring

an experienced pest control professional. These professionals have many more choices of insecticides and application equipment which will improve the effectiveness of control.

Insecticide resistance

Research at Purdue University has shown that 88 percent of bed bug populations across the U.S. are resistant to pyrethroid insecticides. Pyrethroids are the most frequently used bed bug insecticides and include both over-the-counter (OTC) and professional-use products. These studies have shown that once a pyrethroid insecticide application has dried, it may no longer kill the bed bugs. Because of the high level of pyrethroid resistance in field populations of bed bugs, we no longer recommend the use of pyrethroid products for bed bug control.

There are several newer non-pyrethroid products shown to be effective against bed bugs. Currently, these products are only available to pest control professionals.

Heat treatments

Temperatures high enough to kill bed bugs are surprisingly low. All bed bug life stages (adults, nymphs, and eggs) die after a few minutes at 120° F. Some pest control companies use electric or propane heating systems to raise the temperature inside rooms to control bed bugs. Because bed bugs hide inside box springs, wall voids, dresser drawers, under carpets, and in other locations, the elevated temperature must be maintained for several hours to ensure bed bugs in more insulated locations are destroyed.

One obvious advantage of using a heat treatment is that the need for insecticides is greatly reduced or eliminated. In addition, other types of non-chemical control measures such as laundering and vacuuming may not be needed. However, some heat treatments can be more expensive than using insecticides, so consumers are advised to do some comparison

shopping before selecting a pest control company and treatment approach.

Cold treatments

Bed bugs and their eggs die when exposed to cold temperatures below 0°F. Unfortunately, no guidelines are available on how long it takes to kill bed bugs at specific cold temperatures. Research at the University of Minnesota shows bed bugs and their eggs can be killed after four days at 0°F.

Prevention for travelers

After checking into a hotel, it is always a good idea to immediately inspect your room for bed bugs. Because sheets are changed frequently, the headboard is the most likely place to find bed bugs in a hotel room. Headboards are often hung on the wall on hooks. Lift the headboard off the hooks and use a small flashlight to examine the back for bed bugs and their droppings. Untuck linens and examine the mattress and box springs for bed bugs and fecal spots. Be sure to check under the mattress tag and plastic corner guards found on the box springs.

Appropriate handling of your luggage when you return home can help reduce the likelihood of bringing bed bugs into your home. While you are still outside, remove clothing from luggage, place in a plastic garbage bag, and seal with a twist tie. Keep the bags in the garage or another location separate from the house. When you are ready to do your laundry, take the garbage bag directly into the laundry room. Launder items in **hot water** with laundry detergent.

Remove clothes from the bag and put them directly into the washer. Launder them as you normally would with laundry detergent. Items that cannot be washed, such as a wool blazer, can be placed in a medium-hot dryer for 30 minutes. Immediately discard the garbage bag in an outside trash receptacle.

The clothing you are wearing also should be laundered in **hot water** immediately or placed in a dryer for 30 minutes. Remove the clothing as soon as you get inside your home and take it immediately to your laundry area. If you do not have a home laundry, place clothing in a sealed garbage bag and take it to the Laundromat the next time you do your laundry. Shoes can be placed in a plastic bag and placed in a freezer for a few days.

Working with a pest control professional

Successful bed bug control requires careful inspection and use of effective controls. Because this generally requires an experienced individual, we strongly recommend you consider hiring a pest control professional to help confirm and eliminate suspected bed bug infestations. Pest control applicators in Nebraska are certified by the Nebraska Department of Agriculture. They carry a green and red certification card and are trained to apply insecticides in a safe and effective manner. These professionals will have access to professional-use only products and application equipment not readily available to the general public.

Pest control professionals should provide you with a list of actions that must be undertaken before the bed bug treatments can begin. This will likely include dismantling beds and moving furniture away from walls, as well as removing clutter, laundering clothing and bedding, and placing laundered items in garbage bags. For the bed bug treatment to be most effective, it is extremely important to take all the actions requested by your pest control professional.



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