

# Community IPM

## Bed Bugs Are Back—An IPM Answer

J. Gangloff-Kaufmann, New York State Integrated Pest Management Program, Cornell University

Bed bugs mostly troubled wealthy people in medieval times, because they had the warmest homes. But as the quality of homes improved over time, bed bugs became a problem for people of all economic classes. Before World War II, they were a common pest in the U.S. until a combination of factors including pesticides, a household appliance, and fashion nearly eliminated them.

Unfortunately, bed bugs have made a worldwide comeback. They're also turning up in surprising places, such as fancy hotels, hospitals, college dorms, schools, airports, and maybe even your home. Why? Many experts consider globalization a major culprit. People are traveling more widely and in greater numbers than ever before. Bed bugs are nocturnal, small, shy, and easily overlooked—and the adults can live for half a year without food—making them perfect stowaways during travel. But changes in methods of controlling other pests may also be to blame. Pesticide sprays for cockroaches and ants have given way to baits that are very effective, but don't work for bed bugs! Finally, our lack of familiarity with bed bugs and the density of people in cities both play a role in the spread of bed bugs.

So what should you do about bed bug infestations? First, be calm. Although they feed exclusively on blood, bed bugs are not known to transmit any diseases to humans. They may be horrifying to some, but they pose less of a risk to us than do mosquitoes. In fact, if improperly applied, pesticides intended to manage bed bugs could be dangerous to your health. The best strategy to deal with bed bugs is integrated pest management (IPM), which combines a variety of practical techniques and products that pose the lowest risk to our health and to the environment. The first step in your IPM campaign is to make sure that you're dealing with bed bugs and not some other insect.

### What do they look like?

Bed bugs are insects. They are members of the Order of True Bugs, Hemiptera, and the Family, Cimicidae. A few types of bed bugs live in close association with people. The common bed bug, *Cimex lectularius*, and the bat bug, *C. pilosellus*, are often found in homes in the northeastern United States.

Adult bed bugs are straw-colored to reddish-brown, oval bodied insects with undeveloped wings. Their upper bodies are covered with short, golden hairs. Before feeding, they're 1/4–3/8" long (about the size of a lentil) and nearly as flat as a piece of paper—which is why they can fit into such narrow crevices. Their appearance changes dramatically after they've fed; bed bugs become bloated and dark red and have been described as "walking blood drops." Their eggs are VISIBLE – white in color, bean-shaped and about 1/32" long, about the size of a grain of salt, with a "lid" at one end through which the young will emerge. Eggs are laid in crevices, scattered randomly or in small clusters.. Newly hatched bed bugs are light tan but otherwise resemble



Adult bed bug.



Newly hatched bed bug compared with a poppy and sesame seed.

Photo: J. Gangloff-Kaufmann

Photo: J. Gangloff-Kaufmann

tiny adults. Once the youngest bed bugs feed they also appear bright red. From then on bed bugs have a black dot in the belly unless they have recently fed. Bed bugs are gregarious, so you may find adults, young, and eggs in the same location.

## How quickly do they multiply?

Inside buildings, bed bugs can breed all year in continuous generations. The average lifespan of an adult is 3 to 10 months (depending on temperature, humidity and the availability of a host), and in that time, a female may lay more than 100 eggs. The more blood meals a female has, the more eggs she will lay. The female needs to have a blood meal before laying eggs. Eggs hatch in six to ten days. Under ideal conditions, the young can reach adulthood in four to five weeks. Young bed bugs must have a blood meal before they can shed their skins and grow. They shed their skins five times before becoming adults. Under ideal conditions a bed bug population can double every 16 days!

## How bad is a bed bug bite?

The common bed bug (*C. lectularius*) prefers to feed on humans, but will feed on mice, rats, bats, rabbits, guinea pigs, and birds, especially chickens and swallows. Pets such as dogs and cats are not a major host for bed bugs but can be bitten on exposed skin.. The other species of bed bug found in the Northeast, the bat bug (*C. pilosellus*) prefers bats, but when the bats migrate for the winter, these parasites may venture into our living spaces; in a pinch, humans will do.

Bed bugs feed for about five to ten minutes at night, while the host sleeps, then crawl to a sheltered crevice where they will remain for several days while digesting the meal. They will bite any part of the body, but especially areas that are exposed during sleep, such as the face, neck, arms, and hands. You may not see evidence of their feeding because people experience a range of reactions to bed bug bites. Some people are hardly aware they've been bitten and have no itching or marks. Others suffer an allergic reaction to the saliva injected while the insects feed, and develop itchy or painful swellings. For this reason, people in the same household may have different opinions about how "bad" the infestation is, or whether bed bugs are present at all. Heavy infestations of bed bugs have been shown to cause anemia. Bed bug infestation in the home may also cause stress and sleeplessness. Because they can survive for about 70 days without feeding and longer in cool temperatures, bed bug infestations can persist in buildings for periods without people.

## How to inspect for bed bugs

In the early stages of an infestation, bed bugs will be found around seams and crevices of the furniture where the host sleeps. Bed bugs do not roam far from good hiding spots near a reliable host. As numbers increase, they'll spread to cracks in the bed frame and then to gaps behind baseboards, pictures, window and door casings, wallpaper, and other similar shelters. In heavy infestations bed bugs will be everywhere and they will spread to neighboring rooms or units.

Fecal stains, composed of digested blood, may be the first sign of bed bug activity aside from live bugs or bites. They can be tan, brown or black in color and resemble magic marker stains on fabric. Look, also for the insects, their cast skins, and eggs near crevices. Check pillowcases, sheets, and the mattress for fecal stains. Examine the room thoroughly, moving in a pattern that radiates out from the sleeping or sitting area. Use an LED flashlight to peer behind and underneath furniture and woodwork. Look behind all items that are attached to or against the wall. It is also important to inspect new and used furniture before bringing it inside. Look in narrow spaces, along the seams, under folds of cloth, and under cushions.



Hungry (and very flat) bed bug adult on a finger.



Well-fed bed bug engorged with blood.

If you find signs of bats in the building, then you could be dealing with bat bugs. First, remove and exclude bats from the space (See “A Homeowner’s Guide to Northeastern Bats and Bat Problems” <http://pubs.cas.psu.edu/freepubs/pdfs/uh081.pdf>) for more information). In addition to treating the living spaces the bat bugs may have invaded, you’ll need to find the location of the bats’ roost and clean and treat that area.

## *I found bed bugs. Now what?*

There’s no getting around it: if you want to get rid of bed bugs, you need to clean.

A lot. And get rid of all the clutter, especially in your bedroom. Remove things they could hide behind or underneath, such as pictures, posters, area rugs and items on the floor.

### **Vacuum**

Vacuuming with a brush tool is an effective way to remove live and dead bed bugs and the cast skins they leave behind (it works for many other insects, too). To manage bed bug infestations, it’s best to vacuum each area thoroughly, every day. Tilt the mattress, box spring, and furniture upside down so you can reach all sides. Concentrate on seams, creases, folds, and around any tufts or buttons using a crevice tool. Vacuum the furniture, the bed frame, the floor, and baseboards—wherever your inspection revealed the presence of bed bugs. Empty the vacuum immediately. If your vacuum has a bag, you can enclose the bag in a plastic bag that is sealed and discarded. If you have a bagless vacuum dispose of the contents in a plastic bag that is sealed and immediately discarded. Wash the dust canister with soapy water. Note that vacuuming may not pick up all bed bugs and will not usually remove bed bug eggs, which are glued to the surface where they are laid. Further cleaning or treatment will be required.

### **Clean Bed Linens**

Bed bugs are sensitive to extreme temperatures in all of their life stages; the young are more vulnerable than the adults. So toss your sheets, pillows, pillowcases, bed skirt, and blankets into a hot (125°F) dryer for 20 minutes to kill bed bugs. Steam cleaning is another option if it is done thoroughly at a high temperature (over 125°F).

You don’t have to throw out your bedding. Both extreme heat and freezing can also be used to kill bed bugs on clothing and other objects that can withstand such temperatures. Freezing is less reliable and must be maintained for 2 weeks or more.

### **Make Your Bed an Island**

It is possible to get a night of sleep, even if you have discovered bed bugs in your home. The key to comfort is being thorough. First, enclose your mattress and box spring in a bed bug-proof zippered encasement, which can be purchased at furniture or bed and bath stores. This gives you a clean, simple surface for sleeping and also seals in any bed bugs that were on the mattress or box spring. They will not be able to escape or bite through the material. Wash down the bed frame with soapy water and a scrub brush. Keep your bed away from the wall. Wash and dry all linens, bed skirts and blankets and/or throw pillows and linens into a hot dryer for 30 minutes to rid them of bed bugs. Replace and make sure the linens, bed skirt, and blanket don’t touch the floor. This will make it harder for the bed bugs to crawl into your bed. They don’t fly or jump, so crawling is their only option. To prevent bed bugs from climbing the bed legs, use traps that capture bed bugs in a well or moat—there are several brands available. Keep sleeping clothes on the bed and your regular clothes away from the bed. Don’t cross-contaminate. This should provide some relief for sleeping while the bed bug issue is being resolved. When done thoroughly, these steps create a bed bug-free area for sleeping.



Discarded furniture, such as couches, is often infested with bed bugs.

## Seal Crevices

Do your best to eliminate their shelter by sealing the crevices you found during the inspection. Silicone caulk will work well in many areas, such as around window sills or along baseboards, but if you need to fill cracks in the floorboards, furniture, or the bed frame, you may wish to consult with a furniture maker (there are removable caulks that may be appropriate). Repair or remove peeling wallpaper, and tighten any loose light switch and electric outlet covers. Varnishing wood floors can also eliminate hiding spots.

And while you're at it, take the time to try to prevent future invasions if you live in a multi-unit building. That's critical, because you don't want more bed bugs to enter your home from a neighboring area! Bed bugs travel along routes created by pipes and electrical conduits. So seal any openings where pipes or wires or other utilities come into your home. Pay special attention to walls that are shared with other apartments.

## Clean All Your Belongings or Store Them

You do not need to throw away everything you own. Each item can be inspected, cleaned and/or stored for a period of time long enough to kill off any bed bugs. Inspect carefully with a hand lens, looking for live insects or eggs. Wash items with soapy water and dry by hand. For items that cannot be washed store them carefully. Use airtight zippered storage bags for small items that are hard to treat, such as books, artwork, delicate items and anything else that fits inside. Leave the bags in a warm place for 3-6 months. If you see no activity in the bags after a few months, the items are clean.

## Heat Treatments

Heat is an extremely effective tool against all life stages of bed bugs. Temperatures over 125° F will kill bed bugs and their eggs instantly. Thermal remediation is a technique where the home and all its contents are heated to over 135° F to kill bed bugs. This can be expensive but very effective if done correctly. During a treatment thermometers are hidden in the cool spots to verify that lethal temperatures are reached throughout the home. Less preparation is necessary for heat treatment but clutter can inhibit the effectiveness by preventing the flow of hot air. Consult with a licensed professional for more information about thermal remediation.

## Canine Inspection

Many pest professionals now offer canine scent detection to inspect for the presence of bed bugs or verify the effectiveness of a treatment. Canines are dogs especially trained to alert to the smell of a live bed bug or egg. Training and effectiveness varies for canine "teams". False positive results happen when a dog falsely alerts to bed bugs. Dogs may also miss the presence of bed bugs. Most well-trained canine teams are reliable, although the only way to absolutely confirm the presence of bed bugs is to find a live bed bug.

## What About Pesticides?

Pesticides are another option for killing bed bugs, but as early as 1958 there were reports of bed bugs that were resistant to DDT; such resistance complicates efforts to manage populations using pesticides. Some bed bugs can tolerate lethal doses of common pesticides. Luckily, several types of less toxic products for killing bed bugs are now available, and because some of these products work in different ways, bed bugs also won't be able to develop resistance to them as easily.

For example, diatomaceous earth dust works by absorbing the outer waxy cuticle of an insect, causing it to lose water and die. Silica gel is another desiccant dust that is sometimes combined with pyrethrins, which are toxic to insects. They're often used in wall voids and inaccessible places around the home.



Bed bug fecal stains and empty egg shells.



Adult bed bugs and fecal stains on fabric.

Other insecticides include botanical oil products that repel and kill insects; even some cleaning products are labeled for use against bed bugs. Today the standard insecticides used for bed bug control are pyrethroids, which come in a variety of formulas and products. One application system, the total release fogger (“bug bomb”), is specifically NOT recommended for several reasons. Foggers put pesticides where they shouldn’t be, they are ineffective for bed bug control and can cause bed bugs to move to new areas. Additionally, some chemicals have come to the market, but remain as tools for the professional pest management industry. Contact your local Cooperative Extension office to learn about insecticides that are registered for use against bed bugs in your state. In New York, contact Cornell University’s Pesticide Management Education Program at (607) 255-1866 or <http://pmep.cce.cornell.edu>.

## Don’t Give Up Too Soon

Whatever techniques you use to manage the infestation, give them time. It’s extremely difficult to find and penetrate all of the bed bugs’ hiding places in one shot, so even if your IPM approach is working, you may see a few living bed bugs for a week to ten days. After two weeks, if you still see many bed bugs, restart your IPM efforts. Consider the source, especially if it is possible that they are coming in with you from another location, from a neighboring unit or with a person from an outside source. Many times, only by stopping this introduction can the problem be solved.

## Tips for travelers

Bed bugs are often found in places that experience a high volume of overnight guests, such as hotels and motels, hostels, and cruise ships. Remember, they feed at night while you’re sleeping, then retreat to a sheltered crevice by morning. That shelter might be within your luggage or possessions. When visiting a hotel, check the room quickly for signs of bed bugs, such as blood stains on the pillows or linens.

Inspect the seams of the mattress carefully. Peek behind the headboard and wall decor. Bed bugs will hide in these places; if you don’t see them or any signs, there should be no problem.

If you visited an infested place, inspect your luggage and souvenirs before bringing them back into your home. If infested, clothing should be placed in hot dryers; cold treatments might be appropriate for other items.

## Check possible hiding places such as

- seams, creases, tufts, and folds of the mattress and box spring
- cracks in the bed frame and head board
- underneath chairs, couches, beds, dustcovers
- between the cushions of upholstered furniture
- underneath area rugs and the edges of carpets
- between the folds of drapery or curtains
- in the drawers of night stands, dressers, etc.
- behind the baseboards
- around door and window casings
- behind electrical switch plates
- under loose wallpaper, paintings, posters, etc.
- in cracks in the plaster
- in telephones, radios, clocks, lamps and similar objects

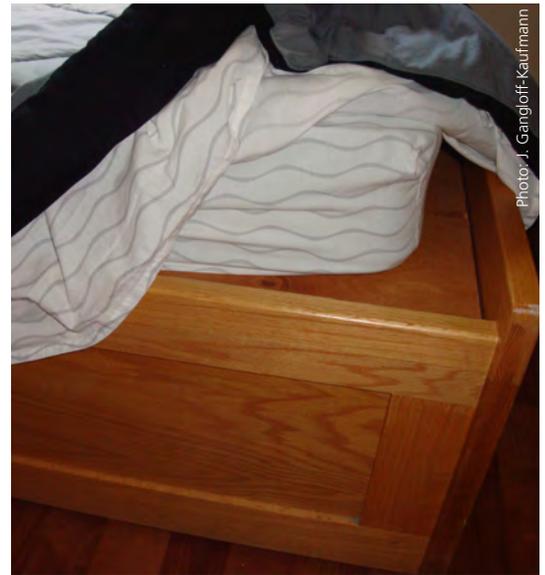


Photo: J. Gangloff-Kaufmann

Inspect the side of the mattress and also beneath it. Bed bugs also hide in gaps in the wood frame.



Photo: J. Gangloff-Kaufmann

Inspect folds in the bed skirt and underneath it as well.



Photo: J. Gangloff-Kaufmann

Inspect the nightstand, drawers, books and the lap and alarm clock for signs of bed bugs.

## The bottom line

For most people, bed bugs are more of a severe nuisance than a medical threat. Humans are generally responsible for introducing bed bugs into new areas; they have a limited home range, but will spread by themselves. With some diligence, you should be able to eliminate the infestation using an IPM approach. First, **identify** the insect. **Inspect** the rooms thoroughly, focusing on the bedroom.

Look for signs of bed bugs, for possible hiding places and for openings that would allow them to enter your home. **Clean** and **get rid of clutter** to eliminate their shelter.

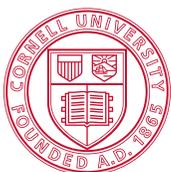
Choose the **removal** methods that best fit your situation; if that includes a pesticide opt for a less toxic one. Make any **repairs and changes in your routine** needed to prevent future invasions.

If you decide to hire a pest management professional to deal with the infestation, ask for an IPM approach. Success will depend on your cooperation. Allow the technicians access to every location that could hide bed bugs, including closets and clothing dressers, and follow their recommendations—especially concerning vacuuming and cleaning.

## Style unmakes the bug

Scientists believe that bed bugs followed us from cave to tent to house. Evidence of their long association with humans includes a 3,500 year-old fossilized bed bug found in an Egyptian village, and references in the works of Aristotle, Pliny, and Aristophanes. Bed bug populations rise and fall following natural cycles. In the mid-1900s, they were a common pest, but their populations declined so dramatically after WWII that today, many people have never seen a live bed bug.

Why did their numbers drop this way? One of the most significant causes was probably the widespread use of DDT to control cockroach populations. Although not the target, bed bugs were also killed by DDT. But changes that had nothing to do with pest control also contributed to their decline, including new home fashions and improvements in vacuum cleaners. As tastes in furniture and home design changed, our homes became less hospitable to bed bugs. Elaborate wooden headboards which provided excellent daytime hiding places are now far less common than they once were. Also, modern homes usually contain fewer oddly-shaped corners than their predecessors. The redesign made homes cheaper to build and easier to vacuum, and that encouraged people to clean more often— more bad news for bed bugs. Today, the vacuum is a formidable pest control tool.



Cornell University  
Cooperative Extension



New York State  
Integrated Pest Management  
Program

Produced by the New York State Integrated Pest Management Program, which is funded through Cornell University, Cornell Cooperative Extension, the New York State Department of Agriculture and Markets, the New York State Department of Environmental Conservation, and USDA-NIFA. Design by Karen English, New York State IPM Program. Cornell Cooperative Extension provides equal program and employment opportunities. © 2013 Cornell University and the New York State IPM Program. Posted 10/2013 at [www.nysipm.cornell.edu/factsheets/buildings/bb\\_are\\_back.pdf](http://www.nysipm.cornell.edu/factsheets/buildings/bb_are_back.pdf)

[www.nysipm.cornell.edu](http://www.nysipm.cornell.edu)