



Residential, Structural & Community Pests

Department of Entomology • NC Cooperative Extension

BED BUGS

By: Michael G. Waldvogel and Charles Apperson, Extension Entomology

Many areas of the country including North Carolina have experienced a significant increase in bed bug infestations in residences, hotels, college campuses and other places. Many people associate bed bugs with unsanitary conditions, as often is the case with pests such as cockroaches. However, bed bug infestations occur across the spectrum of social and economic settings. Experts have speculated that the increase is more likely due to a number of factors such as to be more related to increased travel & tourism, changes in tactics used for controlling pests such as cockroaches, and an increasing resistance by bed bugs to the most commonly used insecticides.

Our primary concern is with the “common” bed bug, *Cimex lectularius*. Another species in the bed bug family (Cimicidae), *Cimex hemipterus*, is usually found in more tropical areas and may show up particularly for people engaged in international travel. A number of other species are more frequently associated with birds and bats but on occasion invade homes.

Identification

Bed bugs adults are reddish-brown, oval, flattened insects about $\frac{3}{16}$ " long and up $\frac{1}{8}$ " wide. Engorged (blood-fed) adults are swollen and dull red. Though wingless, adult bed bugs do have small wing pads. The dark-colored eyes stand out and the sides of the collar-like pronotum curve slightly around the head and is covered with long hairs. The nymphs (immatures) resemble the adult but are smaller in size. Newly hatched nymphs are almost colorless whereas engorged (blood-fed) nymphs are reddish and swollen. Bed bug eggs are white, oval egg is about 1 mm long.



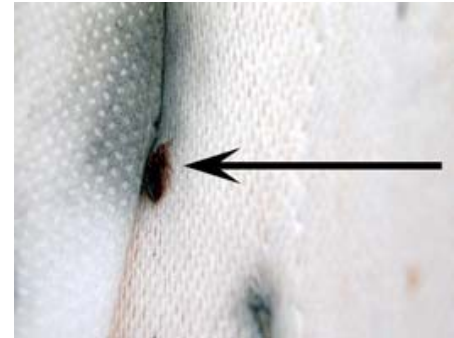
Adult bed bug (Univ. of Kentucky)

Life Cycle and Habits

Although humans are the preferred host, bed bugs feed on many warm-blooded animals including rats, mice, dogs, cats, poultry and other birds. Bats, swallows and chimney swifts may serve as hosts and may be responsible for causing infestations in or around buildings but they are more typically fed upon by other species in those situations.

There has been no scientifically-based evidence showing that bed bugs transmit diseases. Our major concern is more about the affect of their feeding. Bed bugs do not bore into the skin. They insert their mouthparts into the host's skin and suck out blood. As bed bugs feed, they inject saliva which can trigger an allergic that may appear as swelling, itching, and irritation. Some people may not react and exhibit the bite marks while for others there can be a 1-2 day delay before bite marks appear. The marks can persist for a week or more. Large infestations of bed bugs may have a noticeable "sweet" odor.

Bed bugs can feed and breed year round when conditions are favorable. They typically hide during the day on (or in) mattresses/box springs or in cracks and crevices no thicker than an ordinary credit card. The picture to the right shows a bed bug and fecal stains in a mattress seam. Under favorable conditions, each female lays 200 to 500 eggs. When the insects feed regularly, eggs are laid in batches of 10 to 50 at 3 to 15-day intervals. Bed bugs lay more eggs when the temperature is above 70°F (21°C) and tend to stop when temperatures drop below 50°F (10°C). The eggs are coated with a sticky substance that dries after the egg is deposited and causes the eggs to stick to the surface on which they were deposited. Eggs and the eggshells are found, singly or in clusters, in or near the crevices bed bugs are hiding. At temperatures above 21°C (70°F), eggs hatch in about 10 days. At lower temperatures, hatching may take as long as 28 days. Newly hatched bugs feed at the first opportunity. They molt (shed their outer skin) five times before reaching maturity and require at least one blood meal between each molt. Immature stages can survive more than two months without feeding; however, most nymphs usually develop into adults within 2 to 6 weeks. Indoors, three or four generations may be produced and you will find all stages of bed bugs in well-established infestations. Bed bug adults can survive up to a year or more without feeding, which means that infestations may continue to survive even if a house was left vacant for several months.



Bed bug (arrow) and fecal stains on a mattress (NCSU-Entomology)

Bed bugs cannot fly or jump but they can crawl (sometimes as much as 20 feet). They spread primarily through human activity, i.e., people move them from one place to another in luggage, laundry, etc. Piles of nymphs' shed skins often accumulate in and around bed bug hiding places. The picture at the right shows piles of shed skins at the base of bed headboard.



Dead bed bugs and shed skins (NCSU-Entomology)

Eliminating Bed Bugs

Step One - Confirm that you do have bed bugs.

As mentioned previously, bed bug bites often (but not always) leave a reddish slightly swollen welt that can resemble a mosquito bite but typically last longer. The bites may be in a pattern of 3-4 in a row (depending on the number of bed bugs present and how a person lies on a mattress). However, bite marks are not sufficient as the only means determining that there is a bed bug problem, particularly since some people do not react to the bites. It is important that you find actual evidence of the bed bugs: actual insects, shed skins, fecal spots, etc. as shown in the pictures above.

Most of our infestations have been true bed bugs, but on occasion we have had bat bugs and swallow bugs which are difficult to distinguish without a microscope or high magnification lens. A pest control service may be able to help you or you can contact your local county Cooperative Extension Center. If you do have bat bugs, check attics, eaves and roof overhangs for signs of bat activity. If bats are roosting in your attic, contact a pest control company or wildlife damage control company in your area for assistance. Bed bug problems associated with birds or bats are infrequent but it's a good idea to eliminate them as a possible source of an infestation or other potential problems. You should also remove bird nesting material after the birds have left.

Step Two - Locate all of their hiding places:

- Inspect furniture carefully, particularly bedroom furniture. When possible, dismantle the bed for easier inspection and possible treatment. Inspect the mattress and box spring thoroughly. Be sure to check the holes or slots where sections such as the sides, head and foot boards attach.
- Check under and behind other pieces of furniture, such as chairs, couches, dressers, nightstands, etc.
 - Pull out dresser drawers, inspect them carefully and check the interior of the dresser before reinserting the drawers.
 - Check the undersides of lamps, clocks, radio, phones and other objects that might be on nightstands.
 - Pull back the dust covers on the undersides of chairs and couches (if they have them) and check particularly around the legs and frame.
- Remove and inspect objects, such as pictures, mirrors, curtains, etc., that are hung or mounted on walls.
- Check obvious cracks and crevices along baseboards.
- Remove the cover plates on electrical outlets and switches and inspect the boxes for signs of bed bugs.



Bed bug in folds of a fabric seat cover

- Inspect torn or loose wallpaper and decorative borders.
- Check all clothing and other items stored in areas where bed bugs have been found.
- If you traveled in the last few months (vacations or business travel), inspect your luggage as well as the entire closet/storage area (and its contents) where you store your luggage.
- Some pest control companies offer the services of a specially-trained dog to detect bed bugs. We are not endorsing their services specifically, but they can be very cost-effective particularly for large multi-unit properties (hotels, assisted-living facilities, dormitories, etc.). As with any pest control service, make sure you understand the terms and any guarantees before you sign any contracts. The dog handler or his employer must be licensed by the NC Department of Agriculture and Consumer Services. Be a smart consumer and ask about how the dog was trained (e.g., was the training conducted by someone qualified for training dogs in such detection work).



Specially-trained dogs can detect bed bugs (NCSU-Entomology)

Step Three – Control

Effective control, whether it's using chemical and/or non-chemical methods, requires access to the bed bugs and that's where your cooperation is important. Clutter prevents thorough inspection as well as proper (and safe) treatment. Take steps before the treatment begins to make sure that all areas are accessible. For information on preparing your home for a bed bug treatment, see "Preparing Your Home for Bed Bug Treatment"

Chemical Control

The next step is to treat bed bug hiding places and this requires work on your part. There are many products available for bed bug control. Some work strictly as contact insecticides, i.e., they must be applied directly to the insects in order to kill them. By contrast, residual insecticides may remain active on the treated surface for weeks or months after they're applied. **READ THE PRODUCT LABEL TO MAKE SURE YOU UNDERSTAND HOW THE PRODUCT WORKS.** Some products are applied as surface sprays (to exposed surfaces) while other treatments are applied as "crack and crevice" to gaps around baseboards and other such areas and items where bed bugs hide. Insecticidal dust formulations such as diatomaceous earth, silica gel, and more conventional dust insecticides provide longer residual in these locations. Not all dust products are available to the general public and care must be exercised when applying them so you don't inhale the product while applying it. Pesticide applications to furniture, particularly mattresses, should be limited (and perhaps done by a pest control professional). Many pest control services now recommend (or require) that treated



Mattress & boxspring encasements trap bed bugs (Courtesy: Cooper Pest Solutions)

mattresses and box springs be placed inside sealable casements (shown at right) that prevent bed bugs from escaping the treatment and also keep other bed bugs from re-infesting the items. When treating furniture for bed bugs make sure you use only products that are labeled for application to these items. You can click on the following links for examples of pesticides available to the general public and pest management professionals.

Always read the label and follow directions and safety precautions. Here are some important reminders about using pesticides:

- Never use insecticide products that are intended for agricultural use or for outdoor use only. They pose a significant risk to your health.
- Never apply chemicals at higher rates (amounts or concentrations) or more frequently than what is listed on the product label. Overapplying pesticides will not improve control but it can endanger your health. In most situations, a single application does not seem to give complete or immediate control. Additional treatments may be needed in 7-14 days (depending on the product). In some cases, a third or fourth treatment may be needed particularly if all infested sites have not been identified or if it becomes apparent that the bed bugs are resistant to the chemical(s) being used.

Fumigation of a Building or Contents

For extreme or difficult infestations, fumigation may be used (picture at right). Fumigation is not the same as using a "fogger" (total release aerosol). Foggers will not eradicate a bed bug infestation. Fumigation uses a toxic gas and you must either seal the entire house (or entire apartment building) or place furniture and other items into an isolated container (e.g., a panel truck or steel storage container) and sealed for treatment. Fumigating an entire house (or apartment) may require that the entire building be covered with a tarpaulin (or completely sealed) in order to treat it. Fumigation will kill all of the bed bugs and is an alternative to other insecticide applications if an entire house is infested; however, it leaves no residual (killing) insecticide.



Household items being fumigated inside a trailer covered with a tarpaulin (NCSU Entomology)

Non-Chemical Control Options

Some people prefer to dispose of infested mattresses and other furniture rather than deal with treating them. **It is important to dispose of these items properly.** First, you must wrap the items in plastic sheeting before carrying it



Never discard infested mattresses without cutting them open so they cannot be reused.

outdoors so you bed bugs do not crawl onto you or drop off indoors unseen which may further spread the infestation. Second, whether you live in a house or an apartment building, never put infested furniture at the curb or next to a dumpster (if allowed) without first rendering it unusable (e.g., cutting the fabric). Otherwise, someone might take the items further spreading the infestation. Also, if you replace infested items, do not bring them into the house until you know you have the problem under control or else these new items will become infested. Clothing and some other items that are infested (or suspected of being infested) can be washed in hot water (or follow the tag on the article); however, washing alone will not always kill bed bugs and their eggs. Heat (drying in clothes dryer on 'High' for at 30-45 minutes) will kill them. Other items may require dry cleaning which can become an expensive option. Simply isolating clothing or other infested items in trash bags may work but remember that bed bugs can survive for up to a year without feeding.

Physical barriers such as double-sided tape on the legs of beds can help keep bed bugs from crawling onto the frame. However, you must keep bedspreads, blankets, etc. from touching the floor and providing bed bugs with an "alternate" route onto the bed. These physical barriers help but they are by no means a cure for bed bug infestation. There are commercial devices available online that claim to stop bed bugs from migrating onto beds from surrounding areas.

Many pest control companies now offer freezing and/or steam treatments for some types of infested furniture such as mattresses and box springs. Another control method that has proven to be effective is heat treatment. This requires that all of the suspected items or in many cases the entire living area be sealed and heated for several hours to >120°F (picture at right). Heat treatments are not simply a matter of raising the air temperature. The heated air must penetrate all areas of the room/house in order to kill bed bugs that are hiding in household articles, in furniture or clothing, or even in walls.



Heat treatment of an infested apartment.

The best approach to dealing with bed bugs combines both chemical and non-chemical methods in order to provide a greater likelihood of control. However, even with the use of fumigation, heat and/or conventional insecticides, there is currently no treatment method that can prevent bed bugs from being reintroduced into and reinfesting a home or any other building.

Protect Yourself From Bed Bug Infestations

It's difficult to know when and where you might pick up bed bugs. Higher priced hotels or vacation rental properties are no less susceptible to getting bed bugs, but they often have budgets that accommodate more proactive approaches. Despite the best preventive

efforts, almost any property can become home to these hitch-hiking pests. Here are some measures you can take to reduce the likelihood of a problem:

- Check your room carefully, particularly looking for signs of bed bug activity on the mattress or headboard.
- Keep luggage off the floor and check shelves before placing luggage on them.
- Be careful about furniture and other items picked up at yard sales. Never buy mattresses and/or box springs unless they have a tag showing that they were sterilized by a state-certified bedding sanitizer.



Keep your luggage off beds.

For additional information, also see:

Dealing with Bed Bug Infested Items - Insect Note - ENT/rsc-39

Preparing Your Home for Bed Bug Treatment – Insect Note – ENT/rsc-40

Information is also available on the web at: <http://insects.ncsu.edu/Urban/biting.htm>

Any mention of brand names or listing of commercial products or services in the publication does not imply endorsements by the North Carolina Cooperative Extension nor discrimination against similar products or services. All recommendations for pesticide use were legal at the time of publication, but the status of registrations and use patterns are subject to change by actions of state and federal regulatory agencies. Before applying any chemical, always obtain current information about its use and read the product label carefully. For assistance, contact the Cooperative Extension Center in your county.

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