

Control and treatment of bedbugs

From Appropedia

Bedbugs

are a source of discomfort for many people, and are difficult to control. There no known recent U.S. cases of disease

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transmission by bedbugs - see Bedbugs #Disease transmission.

Identification

Signs of bedbugs:

- Bites: Bedbugs are said to bite in a line or a circle, or in 3 bites close together. However, it can be hard to tell bedbug bites from flea bites, and allergic reactions vary between persons and times.
- Small dark stains on sheets or pillow cases (digested blood, to mark a victim's location).
- Papery partial shedded insect skins e.g. between your sheets.
- A sickly-sweet odor

If these criteria don't fit, you may have a different pest, such as fleas, lice or ticks.

Bites

In most observed cases, bites consist of a raised red bump or flat welt, and are often accompanied by intense itching. The red bump or welts are the result of an allergic reaction to the anesthetic contained in the bedbug's saliva, which is inserted into the blood of its victim. Bedbug bites may appear indistinguishable from mosquito bites, though they tend to last for longer periods. Bites may not become immediately visible, and can take up to nine days to appear. Bedbug bites tend to not have a red dot in the center such as is characteristic of flea bites. A trait shared with flea bites, however, is tendency towards arrangements of sequential bites. Bites are often aligned three in a row, giving rise to the colloquialism "breakfast, lunch and dinner." This may be caused by the bedbug being disturbed while eating, and relocating half an inch or so farther

along the skin before resuming feeding. Alternatively, the arrangement of bites may be caused by the bedbug repeatedly searching for a blood vein. People react very differently to bedbugs, and individual responses vary with factors including skin type, environment, and the species of bug. In some rare cases, allergic reactions to the bites may cause nausea and illness. In a large number of cases, estimated to 50% of all people, there is no visible sign of bites whatsoever, greatly increasing the difficulty of identifying and eradicating infestations.

People commonly respond to bed bug infestations and their bites with anxiety, stress, and insomnia.^[1] Individuals may also get skin infections and scars from scratching the bedbug bite locations.

Treatment of bites

It is important not to scratch the bites, as this will make itching worse and possibly lead to scarring. Try the ideas below or elsewhere, to reduce the itch rather than scratching.

Antihistamines have been found to reduce itching in some cases, but they do not affect the appearance and duration of the lesions. Topical corticosteroids, such as hydrocortisone, have been reported to expediently resolve the lesions and decrease the associated itching. Most patients who are placed on systemic corticosteroids to treat the itching and burning often associated with bed bug bites find that the lesions are poorly responsive to this method of treatment.^[2]

Many patients also experience temporary relief of itching and inflammation with the application of hot water to the bite.^[3] The water should be quite hot (about 120 degrees F or 44 deg C) because if it is not hot enough it may cause aggravation of the symptoms. The water should be hot enough to cause minor discomfort, but care must be taken not to burn the skin and this treatment should only be self-administered in order to reduce the risk of a burn. Itching and inflammation can be relieved for several hours by applying hot running water, a hot washcloth, or even using a blowdryer to heat the area of the bite, for 10 seconds to 1 minute (or longer if desired). There is disagreement as to why heat causes the symptoms to abate. Some hypotheses propose that heat overwhelms the nerve endings that signal itch, that heat neutralizes the chemical that causes the inflammation, or that heat triggers a large release of histamine causing a temporary histamine deficit in the area.

Question: Do creams and ointments such as aloe vera help to ease the itching sensation?*suggested project.*

Detection

Bedbugs are known for being elusive, transient, and nocturnal, making them difficult to detect. While individuals have the option of contacting a pest control professional to determine if a bedbug infestation exists, there are several do-it-yourself methods that may work equally well.

Observing by sight and smell

The presence of bedbugs may be confirmed through identification of the insects collected or by a pattern of bites. Though bites can occur singly, they often follow a distinctive linear pattern marking the paths of blood vessels running close to the surface of the skin. The common bite pattern of three bites often around the ankle or shin close to each other has garnered the macabre colloquialism "breakfast, lunch & dinner."

Search for bedbug fecal spots on bedding, upholstery, etc. Also search for bloodstains where bugs have been squished, e.g. by a sleeping human rolling over in bed.

Heavy bedbug infestation give a very distinct odor, the same as the smell of a recently squished bedbug, somewhat reminiscent of cinnamon and clove.

Catching by hand

A technique for catching bedbugs in the act is to have a light source quickly accessible from your bed and to turn it on at about an hour before dawn, which is usually the time when bedbugs are most active. A flashlight/torch is recommended instead of room lights, as the act of getting out of bed will cause any bedbugs present to scatter before you can catch them. If you awaken during the night, leave your lights off but use your flashlight/torch to inspect your mattress. Bedbugs are fairly fast in their movements, about equal to the speed of ants. They may be slowed down if they have engorged on their food source. When the bedroom light is switched on, it may temporarily startle

them allowing time for you to get a dust pan and brush kept next to the bed and sweep the bugs into the pan then immediately sweep them into a jar, cup or mug full of water or alcohol where the bugs drown quickly. Dispose of the water down the sink or toilet. Disinfect the mattress, skirting boards and so on regularly.

Traps

Glue traps placed in strategic areas around the home, sometimes used in conjunction with heating pads or balloons filled with exhaled breath offering a carbon dioxide source, may be used to trap and thus detect bedbugs. This method has varied reports of success. There are also commercial traps like 'flea' traps whose effectiveness is questionable except perhaps as a means of detection. Perhaps the easiest trapping method is to place double-sided carpet tape in long strips near or around the bed and check the strips after a day or more. However, bedbugs can simply walk across the sticky surface of tape, which, while slowing them down, will not stop them from crossing.

A new bedbug trap using heat and chemicals to attract bugs is available from Biosensory, Inc.^[4]

Canine detection

A recent trend in bed bug control is utilizing canine detection teams to pinpoint infestation areas, because hiding places can be very hard to find. A trained dog and

handler can detect bedbugs in a bedroom within minutes, with an accuracy rate of 90%, whereas a (human) pest control practitioner would need an hour to complete the task.^[5] This is a fairly costly service that is not used in the majority of cases, but can be very useful in difficult cases.

Control

Stop infestations from starting

People can bring bedbugs from hotels, motels, or bed-and-breakfasts, or in infested furniture or clothing (used clothing, or their own clothing which has been in an infected location. If someone is in a place that is severely infested, bedbugs may actually crawl onto and be carried by people's clothing, although this is atypical behaviour — except in the case of severe infestations, bedbugs are not usually carried from place to place by people on clothing they are currently wearing.

Bedbugs may travel between units in multi-unit dwellings, such as condominiums and apartment buildings, after being originally brought into the building by one of the above routes.

The cleanliness of the environment has an effect on the control of bedbugs but, unlike cockroaches, it does not have a direct effect as they feed on their hosts and not on

waste. Good housekeeping in association with proper preparation and mechanical removal assist in its control.

Good practices when moving and traveling

When moving house, or when traveling between hotel and hostel and homes, these steps may reduce your risk of spreading bedbugs:

- Wash all clothing and bedding in hot water (above 45 C/113 F)
- Vacuum all furniture or suitcases, paying attention to any cracks and crevices.
- To be more thorough (especially where bedbugs known to exist) wipe down all likely hiding places with alcohol. (Take care to check the surfaces first to ensure they are not sensitive to alcohol.)
- If moving a mattress, examine it carefully for any sign of bedbugs. Infested mattresses are usually discarded.
 - If in doubt, consider replacing the mattress, or treating it. (Wrapping in black plastic and leaving in the sun is sometimes recommended, but is unlikely to uniformly reach the 45 C (113 F) needed to kill bedbugs throughout the mattress.)
 - If desperate and there is no choice but to use the mattress, at least block the bugs' paths, by keeping the mattress wrapped in plastic, and placing the legs of the bed in cups of (alcohol?) to prevent bugs on the floor from climbing up. Also keep all other belongings off the floor.

Question: What strength of alcohol is needed? Straight rubbing alcohol or methylated spirits?*suggested project.*

If operating a boarding house in an area where bedbugs are a problem, insist on all new tenants following these guidelines.

White sheets

Sleep on white sheets - this makes bugs easier to see and kill, and the streaks of blood more obvious. This may help to stop an infestation before it takes hold, so it's a good idea even if you don't currently have a bedbug problem.

Physical barriers

Do not make it easy for bedbugs to move around. Never allow bedclothes to drape on the floor.

It is possible to create makeshift temporary barriers from the insects around a bed. Although bedbugs cannot fly or jump, they have been observed climbing a higher surface in order to then fall to a lower one, such as climbing a wall in order to fall onto a bed. Barrier strategies nevertheless often have beneficial effects: an elevated bed for example, can be protected by applying double-sided sticky tape around each leg, or by keeping each leg on a plastic furniture block in a tray of water.

Killing or removing bedbugs and eggs

Vacuuming can remove bedbugs and their eggs and nymphs from cracks and crevices. (Remember that they can hide in many places, not only mattresses.) Be careful disposing of vacuum bags.

Bed frames can be effectively rid of adult bedbugs and eggs by use of **steam** or by **spraying rubbing alcohol** on any visible insects, although this is not a residual treatment. Small steam cleaners are available and are very effective for local treatment. A suspect mattress can be protected by wrapping it in disposable plastic sheeting, sealing shut all the seams and putting it on a protected bed after a final visual inspection. Bedding can be sanitized by a **120 °F (49 °C) laundry dryer**.

Extreme temperatures, steaming, washing, and dry cleaning

The thermal death point for the common bedbug (*C. lectularius*) is 45°C (113°F), and all stages of life (eggs, nymphs and adults) are killed by 7 minutes of exposure to 46°C (115°F).^[6] However, to ensure that bedbugs do not survive by hiding in locations that do not quite reach the thermal death point, the US Department of Defense recommends using a temperature of at least **49°C (120°F)**, at 20-30% relative humidity, for at least 20 minutes.^[7]

There is uncertainty as to how long bedbugs can survive cold temperatures. Below 16.1°C (61°F), adults enter semi-hibernation and can survive longer.^[8] Bedbugs can

survive for at least five days at -10°C (14°F) but will die after 15 minutes of exposure to -32°C (-25.6°F)^[9] It is believed that storing infested items below -19°C (0°F) for at least four days will be successful. Carbon dioxide deployed in the form of "snow" may kill bedbugs by rapid freezing. ^[10]

Note that the above temperatures apply to common bedbugs. Other species and genera, such as tropical bedbugs (*C. hemiptera*), may have different thermal death/semi-hibernation points. **Question:** can anyone find out what the temperatures applicable to other species are?

Steam cleaning can kill all life stages (including eggs), but the steam does not penetrate very far, so it does not guarantee that all the hidden bugs and eggs will be killed. It can also cause mold to grow later (even "dry steam" has this risk), and it can vaporize toxic chemicals such as pesticide residues, possibly creating health hazards.

Of course, heat has no residual effect, so bedbugs (or other biting insects such as fleas) can return if they are hiding in other places (which is a reason to check and clean in crevices in the room, or behind picture frames, for example). However, simply washing bedclothes and other clothes more frequently, it may be enough to solve the problem, in some cases.

A traditional way to treat a mattress is to lay it under the hot sun and beat it repeatedly with a large stick.^[1] (<http://xelawho.com/bedbug.htm>) Hanging bedclothes in the sun is also often recommended. Unfortunately, this method may disperse the

bedbugs (they run away from high temperatures) without killing them, so they can come back later or move to a new dwelling place. If the mattress is sealed in a plastic bag to prevent this from happening, it is unlikely that the entire surface area of the mattress - even a thin mattress - will become hot enough to kill all the bedbugs, because they can move to whichever side is away from the sun.^[11]

Soap and water should kill bedbugs, but to be safe, wash and dry clothes and bedding at high temperatures, if possible; if not, try pre-soaking (1/2-hour or more) with an enzyme product, and/or oxygen bleach. Once sanitized, bedding should not be allowed to drape to the floor. Dry cleaning should also kill bedbugs, but bedbugs from unclean items in a dry cleaning shop (waiting to be cleaned) can move to cleaned items unless they are immediately sealed in plastic bags with no holes. There have been reports of people opening bags six months after dry cleaning and finding live bedbugs inside.

An effective way to quarantine a protected bed is to store sanitized sleeping clothes in the bed during the day, and bathing before entering the bed.

Alternative treatments that may actually work better and be more comfortable than wrapping bedding in plastic that would cause sweating would be to encase your mattress and box springs in impermeable bed bug bite proof encasements after a treatment for an infestation. There are many products on the market but only some products have been laboratory tested to be bedbug bite proof. Make sure to check to see that the product you are considering is more than an allergy encasement, but is bedbug bite proof.

Controlled atmospheres

Experiments with high concentrations of carbon dioxide have succeeded in killing bedbugs (and humans!) within 24 hours. [12]

Food source isolation

Due to the difficulty in eliminating the bugs from a room or dwelling, a (suspected) bed may be isolated, thus removing the insects' food source - humans. Bedbugs cannot easily cross petroleum jelly or double-sided sticky tape, and have difficulty climbing smooth surfaces of plastic, metal or glass (especially if dusted with talc or diatomite), hence each leg of the bed may be set in a metal can or bowl (the bottom of which may be thickly coated with petroleum jelly) to avoid movement from the bed to the hiding places. A barrier of double-sided sticky tape (such as carpet tape) or petroleum jelly may be applied around each bed leg, or each leg may be set on a plastic furniture block in a tray of water or diatomite.

Although bedbugs cannot fly, or jump over 6 inches, they can climb to a higher surface (up a wall or shelf, or across a ceiling) in order to then fall or glide to a lower one, in order to fall onto a bed. In some dwellings, more barriers may be needed.

Diatomaceous earth (DE)

There are more frequent reports of success in controlling bedbugs by the use of food-

grade diatomaceous earth as an environment-friendly barrier to which the bedbugs cannot easily develop a resistance. The diatomaceous earth abrades the waxy cuticle that covers an insect's exoskeleton, causing them to die of dehydration. Bedbugs exposed to diatomaceous earth typically die within two days of contact, but may survive (and lay eggs) for up to 10 days.

Catching techniques and traps

See under "Detection", above. Some traps may also be useful in eliminating bedbugs.

Natural and chemical pesticides and repellents

Insect repellents appear not to be effective against bedbugs, although it has been suggested that repellents containing eucalyptus oil might work.

Insecticides are effective to some degree. An exterminator may use permethrin insecticide. Permethrin is a neurotoxin and is not known to be harmful to most mammals and humans. However it is highly toxic to house cats and lethal to cold blooded animals (snake, turtle, lizard. etc.). Moreover, bedbugs can develop resistance to pesticides, and even DDT resistance has been reported.

Turpentine (distilled from tree resin and commonly known as paint thinner) kills bedbugs, including eggs, but it also repels them. It is highly toxic and inflammable and must therefore be used with extreme caution.

George Orwell in *Down and Out in Paris and London*^W described having terrible problems with bedbugs, which were only solved by spreading black pepper on the sheets. This also made him sneeze but he thought it was worth it to be rid of the bedbugs.

Biological control (predatory species)

Natural enemies of bedbugs include ants, spiders, mites, centipedes, and the masked hunter or "masked bedbug hunter" (*Reduvius personatus*). Pharaoh ant (*Monomorium pharaonis*) venom is lethal to bedbugs. Rodents eat bedbugs, but bats do not, due to their distaste for the bedbug alarm pheromone, which is released when they are attacked. Unfortunately, biological control is not very practical for eliminating bedbugs from human dwellings. [13]

Traditional and alternative methods

Another method that might be useful in controlling bedbugs is the use of neem oil. It can be sprayed on carpets, curtains and mattresses. *suggested project*. Neem oil is made from the leaves and bark of the neem tree native to India. It has been used safely for thousands of years in India both as a natural, effective insect repellent and it is antibacterial. It has recently received US Food and Drug Administration approval for external use. It is also possible to incorporate neem oil into certain types of mattress. Such mattresses are currently being manufactured by a German company. Some may

find the aroma of neem oil objectionable.

Plants traditionally used as bedbug repellents include black cohosh (*Actaea racemosa*, aka *Cimicifuga racemosa*), *Pseudarthna hookeri*, and *Laggera alata* (Chinese *yángmáo cǎo* | 羊毛草), though information about their effectiveness is lacking.^[14] Eucalyptus *saligna* oil kills bedbugs, and eucalyptus-based insect repellents may be effective.^[15]

In a 1730 book, Englishman John Southam claimed to have learned a formula for a herbal tincture, from a freed slave in Jamaica, that both attracted live bedbugs and killed all life stages of bedbugs (including eggs). Unfortunately, he considered the ingredients a trade secret. A newspaper article from 1730 also prescribes a herbal tincture that contains turpentine and henna flowers.^[16]

Other control issues

Vermin and pets will complicate a barrier strategy. Bedbugs prefer human hosts, but will resort to other warm-blooded hosts if humans are not available. Some bedbug species can live up to eighteen months without feeding at all. A co-infestation of mice can provide an auxiliary food source to keep bedbugs established for longer. Likewise, a house cat or human guest might easily defeat a barrier by sitting on a protected bed. Such considerations should be part of any barrier strategy.

BBC1 aired a television program entitled "The One Show" about the growth of bedbug infestations in London. In the program a pest control officer claimed that the use of

insecticides alone was no longer an effective method to control bed bugs as they had developed a resistance to most if not all insecticides that might be used legally in the UK. He stated that insecticide use in conjunction to freezing bedbugs was the only effective control. All items of clothing and upholstery (including curtains) in the affected household had to be **deep-frozen for at least 3 days in giant freezers** to ensure complete eradication. The exact temperature at which bedbugs must be frozen was not mentioned.

Question: Is it useful to put bedclothes in a regular domestic freezer?*suggested project.* It is easier in most cases to just use a clothes dryer, but where one is not readily available but a freezer is, this would be useful information.

Practical tips for travellers and residents

Since most bedbugs are carried by travellers through contact with beds and hotel rooms in infected locations, following are some tips for those travelling to hotels that might be at risk.

1. First, examine the room for potential hiding places of bedbugs, such as carpet edges, mattress seams, pillow case linings, bedboards, wall trim or other tiny crevices in which bedbugs might hide.
2. Next, look specifically at the mattress seams for signs of bedbug activity: droppings, eggs, bloodstains or even bedbugs themselves, hiding in tiny folds and seam lines.

3. Keep a flashlight nearby when sleeping, to immediately observe suspected activity during the night without having to get up out of bed, thereby giving bedbugs time to hide in safety.
4. Never leave your clothing lying on the bed, or any location of possible infestation (as mentioned above). Instead, use hangers or hooks capable of keeping all cloth distant from the floor or bed. Suspend new shopping in bags the same way.
5. Close all luggage (suitcase, travel bag etc.) when you're not using it. This way, during the night the bugs may move over top of your bags with greater difficulty to get inside.
6. Elevate your luggage off the floor to luggage stand, tables or chairs. These can also be hiding places, but less likely.
7. Use a suitcase with hard sides (not canvas type fabric) and no external zippers. Most zippers do not close 100% but instead leave a very small open space, big enough for bedbugs to squeeze through. Zippers specially designed to be bug-proof (and laboratory-tested) are not widespread but have been included in some mattress covers.
8. Place your luggage in a plastic bag, preferably a sturdy Ziploc-type bag. There are bags specially designed for this purpose that can be found on websites selling bedbug related items.
9. Keep any bedbug you find (intact if possible) to show the hotel owner. (In some countries, such as the United States, hotel owners and apartment landlords have faced legal action and paid financial compensation to victims of bedbug bites.)

Practical tips for hotel and hostel managers

Control

1. Sun the bedding and bed clothes regularly.
2. Place barriers to restrict movement of bedbugs. Do not put beds touching each other.
3. Place barriers (double-sided tape) around the legs of beds.
4. Do not allow bedclothes to drape on the floor.
5. Watch for signs such as bloodstains on the bed and bed clothes.
6. Listen to reports of bites. These may be fleas or bedbugs, but both must be taken seriously, for the comfort and health of guests, and the reputation of your business.
7. See the #Control section above for specific ideas. Make the most of hot sunny weather to treat bedding with boiling water, if you suspect it is infected.

Prevention

When you have minimized the presence of bedbugs through your own control measures then take strong steps to prevent new bedbugs being brought in:

1. Put up signs saying that you have strict rules in order to keep your premises bed bug free. This is for the benefit of guests, and they will appreciate your efforts

(especially if they have been affected by them in the past).

2. Do not allow people to use their own sleeping bags or bed clothes, as these can carry bed bugs and other pests such as fleas.
3. If a resident stays more than a few days, wash or sun their bedding every few days at least.

Question: If guests are asked to shower before sleeping, will this reduce new infestations?*suggested project.*

Current research

The Texas A&M Center for Urban and Structural Entomology and the University of Arkansas Department of Entomology have been collaborating to study bedbugs on a genetic level in the hopes to shed light on their recent resurgence. By studying the genetic variation within bedbug populations, researchers can gain insight into insecticide resistance and insect dispersal. Researchers have two theories as to how bedbug resurgence has occurred in the United States. One theory is that the source of current bedbug populations is from other countries without bedbug pesticides that have made their way through air travel, and another theory is that the surviving bed bug populations were forced to switch hosts to birds, such as poultry, and bats.

The theory that the surviving bedbug populations were forced to switch hosts to birds is also supported by the research carried out at Texas A&M and the University of Arkansas. In a recent study, researchers subjected 136 adult bedbugs from 22 sampled

populations from nine U.S. states, Australia, and Canada to genetic analysis. Their finding concluded that the bedbug populations were never completely eradicated from the United States as there was no evidence of a genetic bottleneck in either the mitochondrial or nuclear DNA of the bedbugs. Researchers suspect that resistant populations of bedbugs have slowly been propagating in poultry facilities, and have made their way back to human hosts via the poultry workers.^{[17][18]}

Other research is being conducted at the University of Arkansas and Virginia Tech to be able to use bedbugs in forensic science. Researchers have been successful at isolating and characterizing human DNA taken from bedbug blood meals. One advantage that bedbugs have over other blood feeders being used in forensics is that they do not remain on the host, and instead remain in close proximity to the crime scene. Therefore bedbugs could potentially provide crucial evidence linking the suspect to the crime scene. Researchers are able to identify what hosts are being fed upon, and are taking further steps to be able to identify the individual by genotyping, and to predict the duration from the time of feeding to recovery of viable DNA.^{[19][20]}

It may be easier to get funding (from the pest control industry) for research on dangerous or expensive remedies, rather than on laundry enzymes.

Notes

1. ↑ Susan C. Jones, PhD <http://ohioline.osu.edu/hyg-fact/2000/pdf/2105.pdf>
Extension Fact Sheet "Bed Bugs, Injury" January, 2004

2. ↑ Mark D. Scarupa and Athena Economides, MD Journal of Allergy and Clinical Immunology "Bedbug bites masquerading as urticaria" Vol. 117, Issue 6, June 2006, p.1508-1509
3. ↑ Sulzberger, M. B., et al. Dermatology: Diagnosis and Treatment. Chicago: Yearbook, 1961; p. 94
4. ↑ <http://www.biosensory.com/nightWatch-bedbug-monitor.cfm>
5. ↑ IPM Practitioner, XXIX(3/4) March/April 2007, <http://www.birc.org/MarApril2007.pdf>
6. ↑ IPM Practitioner, XXIX(3/4) March/April 2007 <http://www.birc.org/MarApril2007.pdf>
7. ↑ US Department of Defense Armed Forces Pest Management Board Technical Guide #44 <http://www.afpmb.org/pubs/tims/TG44/TG44.htm>
8. ↑ http://www.augustineexterminators.com/galleryDetail.asp?gallery_id=26
9. ↑ IPM Practitioner, XXIX(3/4), March/April 2007 <http://www.birc.org/MarApril2007.pdf>
10. ↑ US Department of Defense Armed Forces Pest Management Board Technical Guide #44 <http://www.afpmb.org/pubs/tims/TG44/TG44.htm>
11. ↑ Journal of Economic Entomology 99(6):2132-2135. 2006: "Encasing Mattresses in Black Plastic Will Not Provide Thermal Control of Bed Bugs, Cimex spp. (Hemiptera: Cimicidae)" <http://www.bioone.org/doi/abs/10.1603/0022-0493%282006%2999%5B2132%3AEMIBPW%5D2.0.CO%3B2?journalCode=ecen>
12. ↑ US Department of Defense Armed Forces Pest Management Board Technical Guide #44 <http://www.afpmb.org/pubs/tims/TG44/TG44.htm>

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- L4. ↑ IPM Practitioner, XXIX(3/4) March/April 2007,
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- L5. ↑ Schaefer, C.W. and A.R. Pazzini, eds. 2000. Heteroptera of Economic Importance. CRC Press, Boca Raton, FL.
- L6. ↑ <http://bedbugger.com/2006/12/21/how-about-a-nice-277-year-old-remedy/>
- L7. ↑ Szalanski, Allen L., James W. Austin, Jackie A. McKern, C. Dayton Steelman, and Roger E. Gold. 2008. Mitochondrial and Ribosomal Internal Transcribed Spacer 1 Diversity of *Cimex lectularius* (Hemiptera: Cimicidae). Journal of Medical Entomology 45(2): 229–236link
(http://comp.uark.edu/~aszalan/Site/Site/Publications_files/bed_bug_genetics.pdf)
- L8. ↑ Austin, James.<http://urbanentomology.tamu.edu/bedbugs/bedbugs.cfm>. "Bed Bugs, *Cimex lectularius*."2007
- L9. ↑ Szalanski, Allen L., James W. Austin, Jackie A. McKern, C. Dayton Steelman, Dini M. Miller, and Roger E. Gold. 2007 Isolation and Characterization of Human DNA from Bed Bugs, *Cimex lectularius* L., (Hemiptera: Cimicidae) Blood Meals. Journal of Agric. Urban Entomology 23(3): 189–194link
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- L20. ↑ Szalanski, A.L, J.W. Austin, J.A. McKern, T. McCoy, C.D. Steelman, and D.M. Miller. 2006. Time course analysis of bed bug, "*Cimex lectularius*" L., (Hemiptera: Cimicidae) blood meals using PCR. Journal of Agricultural and Urban Entomology 23: 237-241

External links

- 'Bed bugs – least toxic control' (<http://www.pan-uk.org/Projects/Local/alt~dir/bedbugs.htm>) - alternatives to pesticides fact sheet from PAN UK.
- [2] (<http://www.nyc.gov/html/doh/html/vector/vector-faq1.shtml>) The New York City Department of Health and Mental Hygiene "Vector surveillance and control: Bed bug fact sheet" 12 January 2008
- *My Observations on Bedbugs*, by Dr. Charles A.R. Campbell (<http://www.soilandhealth.org/03sov/0302hsted/030212campbell/campbell%203-1.htm>) (historical interest only)
- Bed Bugs Pest Control Information - National Pesticide Information Center (<http://npic.orst.edu/pestpub.html#BedBugs>)
- KidsHealth.Org: "Hey! A Bedbug Bit Me!" (http://kidshealth.org/kid/ill_injure/bugs/bedbug.html)
- eMedicine, July 2006: *Bedbug bites* (<http://www.emedicine.com/derm/topic600.htm>) , Robert A. Schwartz, MD, MPH, et al.
- Bed Bugs Information: (<http://www.bed-bug.org/>) A look at the history of bed bugs and their effects on society. Includes recent bed bugs lawsuits.
- bed bug (http://creatures.ifas.ufl.edu/urban/bed_bug.htm) on the UF / IFAS Featured Creatures Web site
- Bed Bugs (http://vector.ifas.ufl.edu/chapter_04.htm) chapter in EPA and UF / IFAS

National Public Health Pesticide Applicator Training Manual

- Information portal about Bed Bugs and how to avoid them hosted by David Cain (<http://www.bedbugbeware.com/>)
- www-bedbug.com (<http://www-bedbug.com/>) - a few useful, practical tips, arranged by category.
- more information about diatomaceous earth (<http://www.richsoil.com/diatomaceous-earth.jsp>)
- info and diy fast removal of bed bugs (<http://alanchow76.angelfire.com/bedbugs/>)

Audio and video

- [3] (http://www.kyw1060.com/topic/play_window.php?audioType=Episode&audioId=2744140) Goodnight, Don't Let the Bedbugs Bite. Philadelphia's KYW station speaks to John Russell, general manager of Action Termite and Pest Control about how you get bedbugs and what it takes to get rid of them.
- Bed Bug Central TV (<http://tv.bedbugcentral.com/>) A Bed Bug Video Blog hosted by Entomologist Jeff White.



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