



CHAPTER 18

THE BEST CONTROL FOR BED BUGS

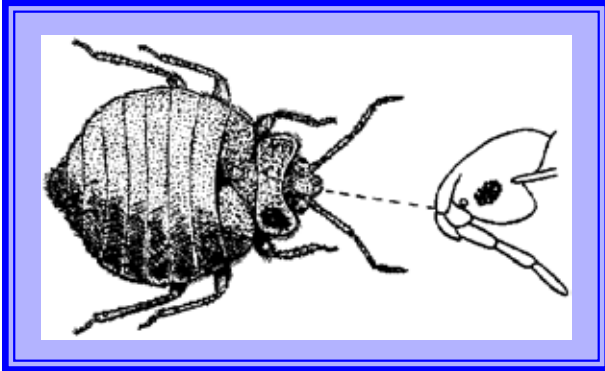
Laura Kruger from the California Department of Health noted: In 70° F. conditions if 40 bed bugs are placed in a room in 6 months their population would reach 5905. The only food of the bed bug is blood!

BED BUGS GENERAL DESCRIPTION

Also known as chinchies, chintzes, mahogany flats, red coats, wall louse, house bug, and crimson ramblers.
“Good night - Sleep tight - Don’t let the bed bugs bite.”

COMMON BED BUG

Cimex lectularius (Linnaeus)



The bed bug is a member of the order Hemiptera. This order's members possess mouthparts which are adapted for piercing and sucking. The lower lip (labium) is modified to form a grooved sheath which receives two pairs of bristle-like stylets, which are the modified mandibles and maxillae. Members of this order are generally characterized by the possession of two pairs of wings, the front pair of which are usually harder in consistency than the hind pair. There are at least 92 known species of bed bugs and their relatives in the world, including the tropical bed bug *Cimex hemipterus* found in Florida feeding on people, chickens and bats, the bat bug (*Cimex adjunctus* and *Cimex pilosellus*), the swallow bug (*Oeciaius vicarius*) and the swift bug (*Cimexopsis nycatalis*)

The hemiptera order includes a number of widely different forms from aphids to water scorpions, but the vast majority are suckers of plant sap. Many species are carriers of important plant diseases. A few species, however, in the family Cimicidae and related families are suckers of mammalian and bird blood and it is to the named family that the bed bug belongs. Lexicologists (those who write dictionaries) do not put a space between “bed” and “bug, but entomologists do.” Their bites (or welts) have been misdiagnosed by dermatologists as flea bites or scabies. They are prolific breeders. **Note: Bed bugs only troubled rich people in ancient times because they had the warmest homes, but bed bugs are very sensitive to a blast of heat.**

Bed bugs are spreading because they practiced traumatic insemination; males slice through the intact female abdomen to deposit their sperm directly into the body cavity of the female. Males and nymphs secrete hormones that label them as sexually unsuitable to prevent injury. Fertilized females avoid the clusters or aggregations of other bed bugs to avoid further injury. These fertilized females generally leave to find a safer place to lay their eggs. Bed bugs are basically resistant to all currently registered pesticide poisons. Only about half of the population notices the first bed bug bite and many bite reactions may be delayed for 10 days. People over 65 either are suspected to react less or are not likely to be bitten. One survey found 42% of those over 65 reported no bites or bite reactions despite the ongoing presence of bed bugs. **Bed bugs cannot detect a host of greater distances than 5 feet.**

Appearance - Bed bugs are oval, flat insects of a straw-colored to a rich reddish-brown *mahogany* color, which has led to their being called *Mahogany Flats*. The legs are well developed and they can crawl up vertical surfaces of wood, paper and plaster and, with difficulty, dirty glass. Their upper bodies are crinkly, like paper, and covered with short, golden hairs. Basically wingless, their forewings are represented by small vestigial scales, the hind wings are non-existent. Their antennae are easily seen and the first two segments appear to be angled. Their compound eyes are also visible and cone-like consisting of about 30 facets. Males may easily be distinguished from females by the end of the abdomen terminating in a rather sharp flap-like segment, while in the females they are rounded. Bed bugs have a bad odor caused by an oily liquid they emit, so routinely clean with Safe Solutions, Inc. enzyme cleaners with or without peppermint. Bed bugs are extremely shy and wary; at night they head for the warmth and odors of the nearest human being. A bed bug can feed nonstop for 10 minutes or more, consuming up to 6 times its own weight of your blood, but you will seldom know you are being bitten. After they have fed, they look bloated and have been described as “animated blood drops”.

ORDER - Hemiptera (means "half-wings")

FAMILY - Cimicidae.

TYPE METAMORPHOSIS - Gradual/simple

TYPE MOUTHPARTS - Sharp, pointed beaks for piercing and sucking.

DISEASE ASPECTS - Bed bugs are not known officially to transmit any diseases. It is, however, possible for them to cause welts and to spread blood infesting disease organisms by biting and to induce nervous and digestive disorders and allergic reactions, especially in sensitive people. In lab tests they have been found to carry the causative agents for anthrax, plague, typhus, tularemia, yellow fever and relapsing fever. Children become listless and pale when they are forced to live in badly infested homes. They give a distinct odor from glands on their thorax. The odd smell has been described as musty, sickening sweet and/or like crushed raspberries and/or like soda pop syrup. They feed mainly on human blood, but they also will suck blood from other animals, birds, and bats and could be vectors of disease organisms from anything they fed on before you! Nymphs usually finish feeding within three minutes, adults take 10 - 15 minutes; they can easily wait 6 - 7 months between feedings! **In fact, bed bugs can live up to a year without food and 18 months without oxygen!**

The wingless bed bug, about 1/8" - 1/4" long is a notable blood sucking parasite of man throughout written history, has moved with him all over the world. The bed bug's adaptation to humans is so complete their bites are nearly painless. In the United States bed bugs have been one of the most important urban human pests; they were disliked more than cockroaches, but DDT so effectively controlled bed bugs in the late 1940s that they are just making a comeback lately. You can see them using a hand lens and a bright light. Bed bugs can be gray or brown in color, changing to dark reddish-brown after feeding, oval or elliptical shape, thin and very flat. Adults are 3/16" to almost 1/4" long and become mature in about four weeks when host blood is available and temperature, humidity, and harborage is favorable. If hosts are scarce, adult bed bugs can survive for about a year without feeding. Their bite is painless. **They can crawl slowly more than 100 feet to obtain a blood meal.**

Hosts include many species of vertebrates besides man, including bats, canaries, guinea pigs, poultry, rodents, dogs and cats. They infest shelters along hiking trails and cabins of summer camps and parks. The surprise occurrence of bed bugs in urban homes often can be traced back to these recreation facilities.

Bites - They have a beak with mouthparts that saw through the skin and a proboscis with two tubes; one injects saliva, anticoagulants and pain killers and the other sucks the blood. Bed bugs are active at night, usually just before dawn. Bed bug bites and their salivary secretions may produce itchy red spots (often in a line) somewhere on your body, normally on the face, neck and arms. Some people are very sensitive to bites from bed bugs and their bites may swell up considerably, scratching causes sores to become infected, wash the bitten area with soap and water or, better yet, diluted enzyme cleaners. Put on some bentonite clay and see your doctor, especially if you experience any allergic reaction or infections, tightness in your chest, or difficulty in breathing. The doctor may treat you with antihistamines, antibiotics and/or epinephrine. Try using Not Nice to Skin Irritations™.

Eggs - 3 - 5 per day and in a lifetime, 200 - 500 yellow-white, elongated eggs, about 1/25" long and slightly curved, they are laid in clusters and are fastened with cement on rough surfaces several times each day in protected places, e.g., ceiling, wall and floor cracks and crevices, cracks of furniture, behind baseboards, under loose wallpaper or in cracks or crevices near the host's sleeping area; up to several hundred might be deposited over a period of two months. Hatching occurs in one to three weeks, depending on temperature - the warmer the weather, the shorter the incubation time. Females stop laying after 11 days, unless they eat.

Nymphs - Nymphs, tiny and colorless at first, go through five molts or instars taking a blood meal between each one. This nymphal period can last from several weeks under favorable conditions to as long as a year when hosts are unavailable and temperatures are low. Similar in appearance to adults, but smaller and straw colored or pale yellow or white in color before feeding - after feeding the nymph turns red or purple. Nymphs can wait up to two months without feeding. Nymphs are about the size of the "R" in liberty on a penny.

Adults - Undergoing gradual/simple metamorphosis, the (shiny) brown bed bugs mate soon after becoming adults. The adults are only about the size of Lincoln's head on a penny. Adult bed bugs prefer humans as

hosts; while they have been known to harbor several human diseases, there has been no record of disease transmission. Fertile males and females. About 3/16" - 3/8" long. Bed bug adults have many long setae on their legs that become captured by the hooked hairs on the surface of the fresh leaves of the common garden bean (*Phaseolus vulgaris*). When full of blood, bed bugs swell and their brown color changes to dark red. They can live an average of about one year. A thin layer of talc makes the surface too slick to crawl on.

Harborage - In the early stages of an infestation, the bed bugs will only be found around the seams and tufts of the mattress. Then, as time passes, they move out and inhabit greater and greater areas. Bed bugs prefer to gather on rough surfaces and prefer wood or paper surfaces for harborages. Under normal conditions, bed bugs feed on sleeping victims at night. Their flat bodies allow them to hide virtually anywhere in dark, tight cracks and mattress seams and under buttons and in holes and voids in beds and walls, bedside furniture, ticking and/or seams of upholstered furniture, electrical outlets, dressers, wall boards, door and window frames, behind pictures and baseboards, under loose wall paper, where beds are joined around slats, around mattress tufts, in bed clothes, hollow bed frames, railings, headboards, under the tack boards of wall-to-wall carpeting, and in rooms near host sleeping areas. Look in any place that offers darkness, isolation and/or protection, e.g., behind wallpaper, mop boards, drapery folds, unused appliances, mattresses, stoves, behind electrical switch plates, in clothing, under carpeting and tack strips, etc. **Inspect at night with a red light only.** Pull out drawers and carefully inspect inside; check mattress seams and buttons; disassemble the bed; check baseboards, upholstered furniture, behind wall coverings. Vacuum all these areas thoroughly and routinely wash the bed and all bed linen with borax. **They normally do not travel far from the host.**

Inspection - The sleeping area is usually the center of a bed bug infestation. All dark, restricted cracks and crevices are potential harborage. Black or brown spots of dried excrement indicate their presence.

- Smell the area; when frightened bedbugs leak a liquid that smells like rotting raspberries.
- Inspect camping sleeping equipment, secondhand beds and mattresses, bedding, furniture, suitcases, outlets, picture frames, clothing and/or even people. Look under carpet tack strips and loose wallpaper.
- Inspect vacant apartments, summer camps, outdoor animal sheds and coops even though not recently occupied. Look everywhere that is restricted, dark and near bedding.

Habitat Alteration - Since bed bugs have alternative hosts besides humans, e.g., rodents, bats, some birds, etc., excluding these animals is very important. While it is difficult, infested woodland cabins must be vermin-proofed. Remove birds, bats, squirrels, rodents and their nests. Caulk and seal all cracks and crevices. Vacuum mattresses, walls, floors, carpet, drapes, etc. and clean frequently especially with diluted Safe Solutions, Inc. enzyme cleaner with or without peppermint. Change bed linen daily or at least weekly; launder (120° F. minimum) with borax. Dust lightly with Safe Solutions, Inc. food-grade DE. Bed bugs can only crawl so move the bed away from the wall and further protect your bed with talc or duct tape, sticky side up, double-sided or silicone tape (or petroleum jelly smeared on the floor) around the bed and on the bed legs.

Inside:

- Vacuuming on a daily basis all of their hiding areas removes bed bugs, their eggs and the dirt that provides them shelter.
- Wash all bed linens at least weekly in borax. Dust all drawers, electric outlets and cracks with talcum.
- Vacuum or steam clean mattresses or spray and clean with diluted Safe Solutions, Inc. enzyme cleaners and/or borax to remove bed bugs and their debris.
- Tighten, caulk, and screen routes of entry. Lightly dust with talcum powder or Comet® or food-grade DE.
- Store mattresses in protected areas. Caulk all cracks and crevices. Reglue loose wallpaper.
- When not in use, do not fold mattresses on cots to prevent mouse nesting. Fumigate the mattresses with carbon dioxide before using them.
- Open protective harborage inside, such as wall voids and spray with Not Nice to Bugs®, diluted enzyme cleaners, food-grade DE and/or borax, or tighten it up completely.
- Put silica aerogel dust or food-grade diatomaceous earth (DE) in wall voids as a last resort.
- Open and vacuum cabinets and drawers. (This also discourages rodent nesting.)
- Make crawl spaces accessible to light and air circulation and inaccessible to rodents.
- Routinely clean with diluted Safe Solutions, Inc. enzyme cleaners and borax.

Outside:

- Move all debris and wood piles away from the structure.
- Keep vegetation and weeds and shrubs away from the foundation.
- Eliminate all garbage and remove rodent pests.

Control - Steam clean all infested mattresses and pillows or wash with diluted enzyme cleaners and/or borax or with a steam cleaner weekly. Take the bed apart and clean it, the room and everything in it with diluted enzyme cleaners. Vacuum or steam clean everything or rinse-n-vac with diluted enzyme cleaners and borax. Caulk and/or seal all cracks and crevices; reglue all wallpaper; practice proper sanitation, exclusion and habitat reduction. There is no tolerable number of bed bugs in occupied structures. Camps and hiking shelters should be treated with poison only when there is evidence of an active bed bug infestation. Rodents found inside should be trapped and removed. Then mop with diluted Safe Solutions Enzyme Cleaner, food-grade DE and/or and/or borax.

- If necessary, use crack and crevice applications of desiccating dusts to treat these harborages thoroughly. Spray and/or clean everything with diluted Safe Solutions, Inc. enzyme cleaner and borax.
- Remember to treat furniture joints; then you can again carefully caulk/seal all openings, reglue all loose wallpaper, etc.
- Do not use space treatments or fogs of synthetic pesticides; they are not effective and are dangerous.
- Read and understand any labels and all labeling.

Follow up - If treated re-infestations recur, evaluate to determine whether some harborage was missed or if the structure is being reinfested, e.g., you may have bats; revise your management plan. Include diluted sodium borate or borax or boric acid when you reclean everything with diluted Safe Solutions, Inc. enzyme cleaner. Monitor structures where periodic reinfestation occurs. Remember, camps used only seasonally should have a pest management plan too. Keep good records on any pesticide poison use and application methods. Educate all occupants and maintain communications. Emphasize that bed bugs are not known to transmit diseases.

Remove all poison rodent baits when (recreational) buildings are occupied.

BAT BUGS

Two species of “bed” bugs can be found in bat colonies, e.g., *Cimex pilosellus* (Horv.) and *Cimex adjunctus* (Barber). These bugs are very similar in appearance to the common bed bug; they do not build up in structures as intensely as the common bed bug. Their host is the bat, but bat bugs wander when hosts leave during migrations or after exclusion. They are also disturbed by reconstruction and bat proofing. If you find an occasional bat bug appearing in rooms usually just below attics - locate infested bat nesting sites and vacuum thoroughly after the bats and detritus have been removed. Wear proper protection and a respirator. Spray or power wash the area with Safe Solutions, Inc. Enzyme Cleaner with Peppermint and/or borax or sodium borate or food-grade DE.

Endangered Species - Be aware of endangered species status of bats and other animals when attempting to control bed bug infestations. Try to use exclusion, sanitation and/or habitat reduction techniques only.

Specific Example

COMMON BED BUG

Cimex lectularius (Linnaeus)

DESCRIPTION

Adult - About 1/6” - 1/4” long, strongly flattened, wingless, flightless and transparent to brown in color (when unfed). After feeding, the bed bug is greatly enlarged, elongated, oval and reddish-brown, rusty red, mahogany or blood colored. They have four segmented antennae. There is also an African (*Leptocimex boueti*) and Indian (or tropical) - (*Cimex hemipterus* - Fabricus) bed bug.

Nymph - Nymphs are similar to the adult, but smaller and paler; after feeding they look like animated drops of blood. The five nymphal stages all resemble the adult, except the cuticle, being not so thick, shows the state of digestion of the enclosed blood meal. Each nymphal stage requires one full meal of blood before it proceeds to the next stage, and the amount of blood taken at each meal is from 2-1/2 to 6 times its original weight, so the

size of the bed bugs varies greatly.

Egg - Eggs are whitish, curved, elongated (1/32" - 1/25") and easily seen by the naked eye. The female bed bug lays her eggs in cracks and crevices in the vicinity of the host and cements them firmly in position. The total number of eggs laid by one female at 77° F. and with frequent feeding, say twice a week, is about 345. The eggs have been described as being like the rubber bulbs of a fountain-pen filler. The cap, which drops off on hatching, is well defined "like a manhole cover". Unhatched bed bug eggs are easily identified from hatched ones, the former being opaque and pearly in color, while the latter are translucent and opalescent. The period of incubation varies with temperature.

Note - There are many cimicids, e.g., bat bugs, *Cimex pilosellus* (Horvath) and *C. pipistrelli* (Horvath) and swallow bugs, *Oeciacus hirundinis* or *O. vicarius* (Horvath), the pigeon bug, *Cimex columbarius* and the Mexican chicken bed bug, *Haematosiphon buginodorus* are all slightly smaller but very similar in appearance and may also feed on humans once the bats or birds are gone. Swifts and swallows are protected by federal and state regulations; so you must call the U. S. Department of Fish and Wildlife **before** removing any swifts or swallows or disturbing their nests. You may ask to lightly spray infested areas with diluted Safe Solutions, Inc. enzyme cleaner, which will not normally hurt the birds.

LENGTH OF LIFE CYCLE - 3 to 18 months, depending upon climatic conditions and available blood supplies. Heat shortens its life. One bed bug female lived 565 days without feeding.

HABITAT - Originally, it is believed these parasites fed only upon bats and then adapted to man as their primary host. Bed bugs inhabit cracks and crevices of rooms where humans and pets sleep, so caulk them all very thoroughly. Hotels, theaters and other public buildings can also be infested. They are transported in antiques, used furniture, especially beds, luggage, baggage and human clothing. There are people who will not let you put their coats on your bed. Activity ceases at low temperatures, e.g., 53.6° F.

NATURE OF INJURY - The bed bug secures itself to your skin with its claws, then inserts its beak, which consists of two stylets or tubes; one is used for sucking up your blood and the other is to inject saliva (or venom) into your wound. Nymphs feed for 3 minutes; adults can continue to suck your blood for 10 - 15 minutes. Bites on humans cause itching, burning and swelling in varying degrees, depending upon the susceptibility (or allergic reaction) of the individual. This irritation is caused by the venom injected as the bedbug feeds. Usually there is a raised, wheal-like bump and there may be 2 - 3 closely spaced punctures visible there. They also have a strong odor that is obnoxiously sweet and they frequently defecate, creating brown, yellow or black stains on the bed linen, mattress and/or walls. **The good news is that bed bugs are not known to transmit disease.**

HARBORAGE POINTS - Bed bugs normally nest on or near mattresses, prefer wood and fabrics and are most commonly found in mattresses between the folds and seams and under the buttons. Other common hiding places are in smoke detectors, joints and cracks of furniture and walls, including bookcases, desks, dressers, chests, night stands, headboards, bedsteads, bed slats and springs. Also closely inspect check upholstered furniture, sofas, narrow spaces, baseboards, window and door trims, voids, loose wallpaper, behind calendars, skirting, floor boards, pictures and mirrors and other likely hiding places, including ceilings. Look very closely. Vacuum and caulk very thoroughly. Pharaoh and Argentine ants, spiders and American roaches have been known to seek out and eat bed bugs. **Bed bugs will also feed upon chickens, mice, rats and rabbits.**

INTELLIGENT PEST MANAGEMENT® CONTROL - **Bed bugs are very sensitive to heat in all stages of their development.** The thermal death point for the common bedbug is only 111° F. to 113° F.; even lower temperatures of 97° F. to 99° F. will kill large numbers of these bugs. Raising the temperature to 140° F. for an hour or 120° F. for several hours should eliminate most infestations. Use a hair dryer to heat or a steam cleaner to steam the cracks and crevices of the mattress weekly using only tap water **or put the entire mattress in a sauna at 170° F.**

Bed bugs are also killed by prolonged exposure to low temperatures (32° F. to 48° F.) Even the eggs die at these temperatures within 30 to 50 days, although adults and nymphs die within hours. So by simply closing off an infested bedroom and leaving it unheated in cold weather should also eradicate any bed bug infestations, as will carbon dioxide fumigation of the mattress and area. **All stages can survive for at least 5 days at 14° F.**

Place mattress, springs, bedding, slats and frames directly in the sun or sauna or in a plastic “bag” made of heavy black visquine and duct taped together or you can add 1# - 3# of dry ice on a paper bag on top of the (plastic covered) mattress to “fumigate the critters”. Thorough cleaning or vacuuming will help but will not completely eliminate the pests. As a last resort, dust talcum powder, medicated body powder, bath powder or food-grade diatomaceous earth (DE) or Comet® into cracks and crevices of floors and baseboards. Clean thoroughly using diluted Safe Solutions Enzyme Cleaner and/or borax as needed. Use a red light and inspect at night. Spray Not Nice to Bugs®. Seal, spray foam, or caulk and paint all infested cracks, crevices and other hiding places.

Steam clean or clean with diluted Safe Solutions enzyme cleaners and/or borax or simply throw out mattresses, furnishings, debris and other objects that serve as nesting sites. Routinely vacuum lint, dust and other debris from mattresses, covers and boxsprings. Caulk all cracks, holes, gaps and openings in walls and moldings. Re-glue all loose wallpaper. Launder and dry all linens, bedding and pads in a clothes dryer or in direct sunlight. If determined necessary later, treat bed frames, springs and mattresses with only small spot applications of talcum powder, or better yet, medicated body powder or Comet®; then as a last resort, insecticidal soap, silica aerogel, or, better yet, food-grade diatomaceous earth. **Never treat any bedding with anything other than bath powder or food-grade DE or Safe Solutions diluted enzyme cleaners.** Then as a last resort spot treat mattresses that must be saved only at seams, folds, buttons or tears with diluted borax or, better yet, with a steam cleaner weekly. After treatment the mattress should be air dried in the sun, and then covered with plastic before use. If all else fails, carefully apply talcum powder, medicated body powder, Comet®, boric acid or food-grade diatomaceous earth (DE) dusts in any/all inaccessible areas; then caulk and/or seal. Remember that thoroughness is the key to permanent bed bug control. All holes, cracks, crevices or other hiding places must be carefully sealed/caulked. Wash everything with diluted Safe Solutions, Inc. enzyme cleaner with peppermint and/or borax or disodium octoborate tetrahydrate. Food-grade diatomaceous earth will control most ectoparasites of this type, but you must avoid breathing even this dust. Try lightly dusting with baby powder containing talc first, but you still should avoid breathing the dust. **CAUTION - Never apply volatile, residual synthetic pesticide poisons or dusts to an infant's, pregnant woman's, elderly person's or an invalid's mattress or anywhere people have breathing problems or are chemically sensitive.** Use several applications spread over a period of two to six weeks intervals of diluted Safe Solutions, Inc. enzyme cleaners, or as a last resort, Not Nice to Bugs®, but **only** when the label permits such usage, and **only** if you cannot simply throw away the infested mattress and everything else has failed to gain control.

In concluding any bed bug eradication, thoroughly inspect all attics and other possible harborage points for bats, rodents and birds. If found, clean up all guano and residue with Safe Solutions enzyme cleaners, remove nests, carefully spray with diluted Safe Solutions Enzyme Cleaner and/or spray with Not Nice to Bugs® and, if determined absolutely necessary, spot treat the area with a least-toxic dust, e.g., food-grade diatomaceous earth or liquid residual pesticide poison. If you decide to dust with food-grade diatomaceous earth, medicated body powder, or the like, carefully spray the material into bed frames, wall voids, cracks and crevices, behind baseboards, into electrical outlets and lightly under furniture, boxes, suitcases and the bed. **Be careful not to allow children or pets access to treated areas!** Heat the infested rooms to 120° F. for 3 - 4 hours. Thoroughly and routinely vacuum lint and dust (and bed bugs and mites) from mattresses; under the bed; in under and behind drawers and furniture; suitcases, boxes, drawers, closets and springs. When finished, properly dispose of the vacuum bag in a sealed plastic bag. You also could rinse-and-vac and/or routinely and thoroughly clean with diluted Safe Solutions Enzyme Cleaner, peppermint soap, borax and/or disodium octoborate tetrahydrate. **See Bats.**

Caution: Wear safety glasses, masks, gloves and wash all clothing and yourself thoroughly after entering any bat infested attics, especially any with any visible feces or guano. Remember, bed bugs have developed resistance to several “registered” insecticide poisons.

If you want a bed bug history lesson, check out: <http://antiquity.ac.uk/ant/073/Ant0730908.htm> or <http://www.reshafim.org.il/ad/egypt/timelines/topics/pests.htm>. Aristophanes wrote “The Clouds” in 423 B.C.E. and was the first to refer to bed bugs living in a couch. Eva Panagiotakopulu, a University of Sheffield archaeologist, found that bed bugs have lived with man for at least 3500 years. She found several other ectoparasites of man, including fleas in samples of excavated garbage at the ancient city of Tell el Amarna (1352-1336 B.C.E.) in Egypt. A 1920s guide advises treating infested mattresses with “high-test gasoline” and 1935 guide prescribed powdered calcium cyanide. There are currently 673 pesticides that are “registered” and still available to “treat” bed bugs, but the Author does not recommend the use of any terrible poisons.

Bed bugs have been used in Morocco as a love potion. The Yiddish word for bed bug is vantz; plural vantzen.

Bed Bugs - Typical First Strikes by Housekeeping and Maintenance

1. Carefully inspect for fecal spots, egg cases and cast skins (exuviae). Look behind wall paper, pictures, inside closets, drawers, cabinets, undersides of windows, door casings, moldings, cracks and crevices and the bed and frame, clock radios and/or night stands. Check the clothing, bed linen, bags and suit cases of travelers and visitors. Regular cleaning and the elimination of clutter are your best protection. A stiff brush can be used to clean the mattress seams in order to dislodge bed bugs and their eggs. Routinely spray Not Nice to Bugs® and/or clean with borax and Safe Solutions Enzyme Cleaner with Peppermint (1 oz. and 1/8 c. borax per quart of water). Tape all torn box springs and mattresses with duct tape or cover completely with shrink wrap or plastic wrap or, better still, replace them or enclose them in a zippered mattress encasement cover used for dust mite control to physically exclude bed bugs. Bed bugs are harder to control if you have pets, which are also hosts for bed bugs. If you can protect you bed with mattress encasements and traps, bed bugs will not be able to eat and females will stop laying eggs after 11 days without eating. The problem is highest in high rises. In one 253-unit apartment house, bed bugs spread from one unit to 101 units within 41 months.
2. Steam clean with a steam iron or a low vapor steamer at 220° F., enclose in plastic or replace the mattress. Be very sure the mattress is dry or you can create a mold, mildew and/or dust mite problem. **(Be sure to touch all suspect surfaces with the nozzle that is releasing the steam.)**
3. Stand the legs of beds on glue boards or in soapy water or in metal jar caps lightly dusted with talc; coat the legs of the bed with talcum powder or petroleum jelly (Vaseline) or double-sided carpet tape. Place duct tape, sticky side up, around the bed, bed legs and room; you can hold the duct tape in place with masking tape on the edges. Bed bugs can't climb on polished glass or metal easily, so the bed legs can be placed in glass jars or metal cans. Do not let bed covers touch the ground or the bed touch the walls. See also Typical First Strikes for Spiders. Use duct tape, sticky-side up, to monitor for bed bug infestation in the same way I do to check for cockroaches.
4. Raising the temperature to 97° F. - 99° F. will kill most bed bugs in several days; lowering the temperature to 32° F. to 48° F. will take up to 50 days to kill all of the eggs. A hot dryer (140° F.) will kill all stages of bed bugs in 20 minutes. Use a dryer or place infested items into a black bag in the sun on 70+ F.-degree days to kill them on clothing, toys, etc. Use a sauna for larger items. Carefully treat the mattress seams and buttons with a hair dryer or, better yet, a heat gun and then vacuum. Carefully treat the mattress, seams and buttons with a hair dryer or, better yet, a heat gun and then vacuum. Cover the mattress with an impervious cover. Bed bugs retain moisture and survive like desert arthropods, so dry out the infested area. Bed bugs retain moisture and survive like desert arthropods, so dry out the infested area.
5. Routinely launder with borax and dry bedding at high temperatures to remove bed bugs and their eggs.
6. Caulk and/or dust with food-grade DE all cracks, crevices and other openings.
7. Discourage bats, birds, rodents and other animals from living in, on or near human dwellings.
8. Routinely clean and practice good housekeeping. A strong vacuum cleaner with proper tools will dislodge bed bugs from cracks, crevices and seams. Treat the carpet like it is a flea control project.
9. Inspect with red lights or night vision glasses at night; have a 'victim' in bed as you watch.
10. As a last resort, take the bed apart and fumigate the mattress with CO₂ inside a thoroughly sealed plastic cover. Use a respirator and carefully and lightly dust all joints, the mattresses, folds, edges and then carefully treat all cracks and crevices in the affected rooms with Safe Solutions, Inc. food-grade DE or fine body bath powder. Liberally sprinkle fine body bath powder over all sides of the mattress and then work the dust into the mattress. Your bed bugs should disappear overnight. Cover the mattress with a plastic cover before sleeping on it again. **Try turning off the heat in your infested bedroom. Bed bugs can only survive in the range of 48° F. to 97° F. Try disinfecting the bed with ultraviolet light.**
11. Put infested and suspected material in a black plastic trash bag and set it in the hot sun all day. Most insects die when exposed to 115° F. for 30 minutes or so, or you can bag the items and freeze them.
12. In tropical countries you soak your mattress in hot water and put it in the sun. The sun dries the mattress and in so doing the hot water kills all of the bed bugs. See Typical Strike #2.
13. Place a heating pad on the floor with fresh bean leaves or several glueboards or sticky traps adjacent to the pad or with duct tape sticky-side up surrounding the heating pad. Lower the temperature of the room and leave the pad on all night. In the morning check for any bed bugs trapped in the glue or fresh bean leaves. You can improve the trap by putting an Alka-Seltzer tablet on a damp sponge on a small plate on the heating pad. Make sure the tablet does not dissolve too quickly — the slower the better. Another in

expensive and effective trap is to place a styrofoam cup full of dry ice in a pet food bowl lightly dusted with talcum powder.

14. As you travel, always check behind the hotel room headboard for bed bugs.
15. Cluttered conditions can cause a complete failure of any bed bug control program, so wash and remove clutter, e.g., clothes, pictures and other hiding areas from your infested bedroom.
16. Still having problems? Read the rest of the chapter.

Note: Cockroaches are wonderful predators of bed bugs. While Vapona® strips might work after 2 weeks, the Author believes they are dangerous to people and are already restricted to special situations.

Bed Bug Control Notes: If you truly have bed bugs, remember they are not very mobile and normally will not be far from “dinner” and they were not known to carry diseases. They are most vulnerable when you can see them. They are easily suffocated by fine powder and die when directly sprayed with Not Nice to Bugs® or diluted Safe Solutions Enzyme Cleaner. Try using flannel sheets on the bed or under the heating pad to trap them and then vacuum the sheets every morning or put them in a clothes dryer. Remember, they can wait up to a full year to suck your blood at night. Be sure to cover your mattress with an impervious mattress cover. You can also purchase a Nano-UV Wand or ultraviolet light scanner from Safe Solutions.

Bed Bugs Can Transmit Disease - Historically it was thought that bed bugs didn't transmit disease. But researchers in Vancouver recently reported that they had found bed bugs with methicillin-resistant *Staphylococcus aureus*, or MRSA. The scientists crushed and analyzed five bed bugs and found three samples with MRSA, the superbug that is resistant to most commonly used antibiotics. The two other samples had vancomycin-resistant *Enterococcus faecium*, or VRE, a less dangerous antibiotic-resistant bacteria.

Natural fungus may provide effective bedbug control.

According to Nina Jenkins, senior research associate at Penn State entomology, preliminary bioassays on the effects of *Beauveria bassiana* -- a natural fungus that causes disease in insects -- on bedbug control have been performed, and the results are encouraging. She and her colleagues report their results in the most recent issue of the Journal of Invertebrate Pathology.

Jenkins, working with Alexis Barbarin, a former Penn State postgraduate student now at the University of Pennsylvania, Edwin Rajotte, professor of entomology, and Matthew Thomas, professor of entomology, looked at how *B. bassiana* acts through contact with its insect host. In the study, the researchers used an airbrush sprayer to apply spore formulations to paper and cotton jersey, a common bed sheet material. Then control surfaces, again paper and cotton jersey, were sprayed with blank oil only. The surfaces were allowed to dry at room temperature overnight. Three groups of 10 bedbugs were then exposed to one of the two surfaces for one hour. Afterward, they were placed on clean filter paper in a petri dish and monitored. **The researchers found that all of the bedbugs exposed to the biopesticide became infected and died within five days.**

Also, there were no prominent differences in susceptibility by feeding status, sex, strain or life stage. Most importantly, the infected bedbugs carried the biopesticide back to their hiding places, infecting those that did not go out in search of blood. “We exposed half of a population of bedbugs to a spray residue for one hour and then allowed them to go into a harborage with unexposed individuals,” said Jenkins. “The fungal spores were transferred from the exposed bugs to their unexposed companions, and we observed almost a hundred percent infection. So they don't even need to be directly exposed, and that's something chemicals cannot do.” **This result is important because bedbugs live in hard-to-reach places.** <http://live.psu.edu/story/62832>

Beauveria bassiana can also be used as a biological insecticide to control a number of pests such as termites, whiteflies, and many other insects. Its use in the control of malaria-transmitting mosquitoes is under investigation. As an insecticide, the spores are sprayed on affected crops as an emulsified suspension or wettable powder or applied to mosquito nets as a mosquito control agent. *Beauveria bassiana* parasitizes a very wide range of arthropod hosts. However, different strains vary in their host ranges, some having rather narrow ranges, like strain Bba 5653 that is very virulent to the larvae of the Diamondback Moth and kills only few other types of caterpillars. Some strains do have a wide host range and should therefore be considered nonselective biological

insecticides. These should not be applied to flowers visited by pollinating insects.

The fungus rarely infects humans or other animals, so it is generally considered safe as an insecticide. However, at least one case of human infection by *B. bassiana* has been reported in a person with a suppressed immune system. Additionally, like any powder, the spores may exacerbate breathing difficulties.



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or by telephone at: 1-888-443-8738..