

BED BUGS

The bed bug (*Cimex lectularius*) is the most common 'true bug' that bites people in the U.S. It has sucking mouth parts in the form of a hollow, needle-like proboscis. Bed bugs' have wings, however they are not functional; movement is by crawling only.

BIOLOGY

Bed bugs have three life stages; egg, nymph and adult.

Eggs

The egg is 1/32 inch (1 mm) long. The female bed bug lays eggs in cracks in furniture, folds of mattresses or on other rough surfaces. She uses an adhesive cement to secure the eggs to the substrate. The eggs hatch within 7-10 days in favorable conditions.

Nymphs

When the egg hatches, a tiny nymph emerges; it resembles a miniature version of the adult. Bed bugs only feed upon blood. The newly emerged nymph must crawl away from its birth place and find a host to feed. If it survives, the nymph will molt five times into successively larger nymphal stages until it become an adult. The nymph (or adult) finds a host by random wandering until it comes within range. Body heat, carbon dioxide and natural scents given off by the host, are used by the bed bug to locate a host.

Once the nymph finds a host, usually a sleeping person, it unfolds its proboscis and pushes it into the skin until it reaches a capillary. It then begins to pump blood into its gut. Feeding takes about 3 minutes.

Adults

The adult bed bug is about 1/2 to 7/8 inches (13-23mm) long and distinctly flattened. As with the unfed nymphs, the adults are pale brown. All bed bugs turn bright red after feeding and their abdomens expand and elongate greatly. As bed bugs digest their blood meals over the ensuing days, their abdomens subside and their pale brown color returns.

Female bed bug eggs can lay 1-5 tiny white eggs per day. Over her life time she may lay 200-500 eggs. The time required from egg hatch to adult is typically 4-5 weeks.

Bed bugs spend most of their lives in motionless hiding. They prefer to squeeze into such hidden places as cracks in furniture, box springs, mattresses, behind pictures, in screw holes, behind the head boards of beds and beneath carpets. Once they have fed, bed bugs can go without another meal for many weeks or even months. This tendency to hide and their ability to survive for so long without feeding, make control difficult.

REASONS FOR THE RECENT RESURGENCE

Bed bugs were common in the US until the advent of DDT and other highly effective insecticides in the late 1940's, as well as improved household activities, such as more frequent laundering of cloths and bedding. The insect was rarely heard of again until the 1990's. Bed bug cases are

now (2010) one of the most frequent reasons for calls to pest control companies. The reasons for this increase are believed to include the following:

1. Loss of Certain Insecticides and Treatment Procedures

Organophosphate and carbamate insecticides were commonly applied as base-board treatments up until the 1990's and were highly effective. These two groups of insecticides are no longer allowed to be used indoors in the US.

2. Baits

The base-board treatments have largely been replaced by bait stations and bait applied as a caulking into cracks and crevices for ant and cockroach control (these insects feed on the bait and die). Since bed bugs will not feed on these baits - they only feed on blood - they are unaffected.

3. Increased Air Travel

Air travel has increased greatly in the last few decades. This enables travelers from other countries, where bed bugs are common, to bring them quickly to the US in their luggage. Even high quality hotels have been affected.

4. Resistance

Bed bugs have developed resistance to several insecticides and are no longer killed by them.

HEALTH & SOCIO-ECONOMIC ISSUES

Bed bugs have not been found to transmit any diseases, in marked contrast to many other blood-feeding pests, such as mosquitoes, fleas and ticks.

The bite is painless to most people, but bites can lead to allergic reactions. People vary greatly in their reactions to bites; some develop dark red wheals while others show no reaction. Individuals who do not respond to bites initially, can become sensitized from repeated bites and subsequently develop dramatic reactions from later bites.

People who realize that their homes are infested, or have suffered a sleepless night at an infested hotel, or whose children bring bed bugs back from college, are faced with a problem which is very hard to solve. Bed bug sufferers should seek the services of a pest management company experienced in controlling this pest.

CONTROL

Detection

The first step is to have a thorough inspection of the infested premises by a pest management professional (PMP). The inspection, if done correctly, will take a lot of time as the PMP will be looking for an insect that is adept at hiding. The treatment should be tailored to the specific infestation, whether it is in the home, a rental apartment or an entire hotel or college dorm. Specially-trained dogs are now available for detecting hidden bed bugs, which allows the PMP to target the infested areas and avoid unnecessary treatment.

Physical Control

i.) Eliminate Hiding Places

Clutter should be eliminated as this reduces places where bed bugs can hide and shelter from any insecticidal or heat treatments. Heavily infested items should be sealed in a plastic trash bag to prevent escape and disposed of appropriately.

ii.) Removal

Vacuumping will remove some exposed bed bugs, such as when a mattress is lifted to reveal a mass of scurrying bugs. But vacuuming is of little use for bed bugs in hiding or for their eggs, which will be stuck to the substrate. Bed bugs will cling to rough surfaces, making vacuuming more difficult. The contents of the vacuum must be promptly placed in plastic bag and sealed, otherwise the bugs will escape.

iii.) Heat Treatment

Bed bugs and their eggs are killed when exposed to temperatures of 113⁰ F for at least one hour. Heat treatment is odorless and involves no chemicals. Entire buildings, room, beds, mattresses and infested furniture can be treated with specially-designed equipment that uses dry heat. Heating can damage some items. Some pest management companies use steam treatment to control bed bugs. The steam should be as dry as possible so that drying time is minimized and the risk of mold is reduced in treated fabrics.

Bedding and should be laundered with hot water and then put in a clothes drier at a temperature of at least 179⁰F for 5 minutes.

Chemical Control

There are a limited number of insecticidal products approved for control of bed bugs. Many of the older insecticides, which could formerly be used indoors for control of bed bugs, are no longer approved for use. Recently, university and USDA researchers have documented that many bed bug populations in the US (and elsewhere in the world) have developed resistance to certain insecticides. This is to be expected whenever a population of an insect species is repeatedly treated to one insecticide, or to a group of chemically-related ones. Survival of the insecticidally-resistant individuals is greatly enhanced and subsequent generations become increasingly resistant to the insecticide until it is no longer effective.

Other products contain silica dust, with or without natural pyrethrins, diatomaceous earth or ground limestone. These mineral products work by abrasion of the waxy cuticle of the bugs, increasing water loss, which leads to death by desiccation. They are slow-acting and may require low relative humidity to be effective.

Some insecticidal products labeled for bed bug control are allowed to be applied to mattresses and some are not. This is an important distinction. The choice of insecticide should be left to the PMP, but the customer should ask which one has been selected and request an MSDS (Material Safety Data Sheet) for all chemicals used.

Exclusion

Mattresses and box springs can be enclosed in specially-designed 'encasements'. These are large, zip-up bags which bed bugs cannot bite through, escape from or enter. Thus the bugs

in an infested mattress cannot bite anyone lying on it and they cannot escape. Similarly, bed bugs which have recently fed cannot get into the mattress to hide.

Prevention

The old adage that 'a stitch in time saves nine', was never so true as in the case of bed bugs. Homeowners, landlords and others responsible for residential properties should strive to prevent infestations. Refuse to allow used furniture, especially mattresses, box springs and bedding into one's property. College students returning from break should keep their clothes in sealed plastic bags until they can be washed. Wash on hot cycle and then dry for an extended period. Items which cannot be washed and dried, e.g., woolen articles, books, class folders, should be placed in sealed bags until they can be put in a freezer and left for an extended period. Authorities differ on the temperature and duration of freezing required to kill all bed bug life stages, but two days in a household chest freezer at 20^oF should be adequate.

References and Further Reading

The following books were used as sources for much of this article. They are recommended as further reading for those who want to know more about this fascinating and challenging pest.

Pinto, L. J., R. Cooper and S. K. Kraft 2007. Bed Bug Handbook: The Complete Guide to Bed Bugs and Their Control. pub. Pinto and Associate, Inc. 266 pages
An excellent, up to date book.

Mullen, G. and L. Durden. 2002. Medical and Veterinary Entomology, pub. Academic Press. pp 80-86
Good standard undergraduate level text book.

Smith, E. H. and R. C. Whitman. 1996 revision of 1992 original. NPCA* Field Guide to Structural Pests. pub. NPCA pp 3.1.1-2
**National Pest Control Association*, now the *National Pest Management Association*
A good, quick reference guide, now slightly outdated.

Usinger, R. L., 1966. Monograph of Cimicidae. pub. Entomological Society of America 585 pages.
The classic reference book on bed bugs and other members of the family Cimicidae.