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Battling **BED BUGS** in Apartments

Almost no field research has been conducted on bed bugs in a generation. This study examines efforts to control infestations in apartments with 21st-century products.

The common bed bug, *Cimex lectularius*, is fast becoming the most worrisome indoor pest of this generation. Like cockroaches, with an attitude, bed bugs are transforming the way people live and travel — just as they did in the past. Infestations are arising in almost every habitable location, ranging from homes to hospitals. Outbreaks in hotels and motels have been the most newsworthy, but infestations in apartments can be even more problematic.

BED BUG HEAVEN. Apartment buildings afford near-perfect living accommodations for bed bugs. Large numbers of occupants reside in close proximity to one another. Tenant turnover is constant, affording many opportunities for the bugs to be transported in on beds, couches and other items. In

some low-income housing facilities, bed bug-laden items are as likely to arrive from the curb or Dumpster as from the moving van. Visits by guests help to spread infestations, as does communal use of laundry facilities. Poor resident cooperation also can be a problem, and we have seen serious misuses of pesticides by tenants attempting to control infestations themselves from the bed bug perspective, though the greatest survival advantage of apartments may be clutter. Much as with cockroaches, clutter and close living quarters provide endless places for the bugs to hide, thrive and avoid extermination.

FIELD TRIAL. Bed bug management tactics include such measures as laundering, vacuuming, heating, bed encasement, and

disposal of infested items. Treatment with insecticides, however, is by far the main approach used by pest control companies.

Despite this, very little has been reported on the outcome of modern-day insecticide treatments for bed bugs in challenging

environments such as apartments.

To remedy this lack of knowledge, in 2005, we initiated such a trial using insecticides commonly applied by pest managers. Thirteen bed bug-infested apartment units in Cincinnati, Ohio, were identified by a local firm specializing in bed bug control in this market (Permakil Pest Control, based in Covington, Ky.). Four of the 13 units were located within the same apartment building, two were from another building, and the remaining seven were located in separate buildings around the city.

Most of the apartments were rented by tenants in the low- to mid-income range. Each unit was thoroughly inspected before initial treatment, recording numbers of live bed bugs (adults and nymphs) residing on beds, furniture, floors, walls, ceilings and other locations. Pretreatment infestation levels varied widely from a low of eight live bed bugs found in one apartment unit to almost 3,000 in another. Adjoining units were also inspected and treated if necessary in a manner similar to the test units.

Prior to treatment, residents were asked to remove, bag and launder bed linens and clothing. Some tenants complied with this request while others did not. Tenants were not asked to disassemble beds or dispose

BED BUG FACTS

- Adult bed bugs are about 1/8-inch long with reddish-brown, oval flattened bodies. The nymphs resemble the adults but are smaller and somewhat lighter in color.
- Bed bugs feed solely on the blood of animals. The common bed bug, *C. lectularius*, prefers feeding on humans, but will also bite other warm-blooded animals, including pets.
- They feed by piercing the skin with an elongated beak. The person seldom knows they are being bitten. Bite symptoms vary from an itchy welt or localized swelling to little or no reaction.
- Although they can harbor pathogens in their bodies, disease transmission by bed bugs to humans is considered highly unlikely.
- Bed bugs do not fly but can move rapidly over floors, walls, ceilings and other surfaces. If necessary, they will crawl more than 100 feet to obtain a blood meal.
- Female bed bugs lay their eggs in secluded areas, depositing up to five a day and up to 500 during a lifetime.
- The eggs are whitish and hard to see on most surfaces without magnification. Individual eggs are about the size of a dust speck. When first laid, the eggs are sticky, causing them to adhere to substrates.
- Newly hatched nymphs are no bigger than a pinhead. As they grow, they shed their skin five times before reaching maturity. A blood meal is needed between each successive molt.
- Under favorable conditions (70°F to 90°F), the bugs can complete development in as little as a month, producing three or more generations per year.
- Nymphs can survive months without feeding and the adults for more than a year. Infestations are therefore unlikely to diminish by leaving premises unoccupied.
- Bed bugs are active mainly at night. During the daytime they prefer to hide close to where people sleep.
- Bed bugs do not have nests like ants or bees but do tend to congregate in habitual hiding places. Typically these areas are marked by dark spotting and staining, and sometimes are accompanied by a sweetish odor. Also present will be eggs and eggshells, and molted skins of maturing nymphs.

Information adapted from the August 2004 PCT hand-out, "Your Guide to Bed Bugs," by Michael F. Potter. To order copies, contact Megan Ries at 800/456-0707.



Clutter is a major impediment to controlling bed bugs in apartments.

BED BUG COUNTS

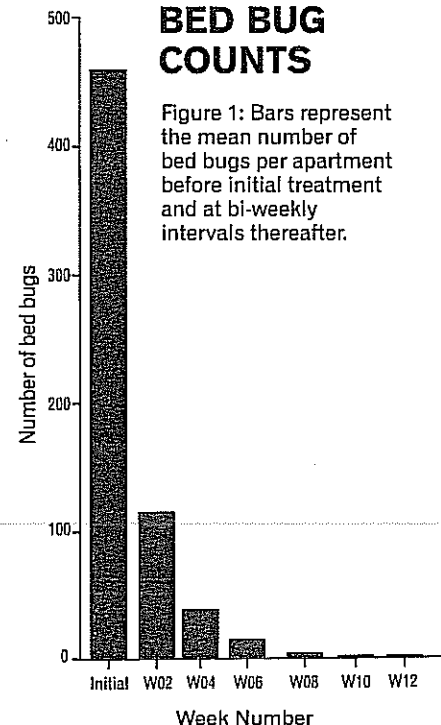


Figure 1: Bars represent the mean number of bed bugs per apartment before initial treatment and at bi-weekly intervals thereafter.

Source: University of Kentucky



Thorough inspections and counts were made of the bed bugs in each apartment.

All 13 apartments were treated with Suspend[®] SC (0.06 percent deltamethrin) as the primary liquid insecticide. Applications were thorough, targeting areas where bed bugs were found or likely to crawl or hide. This included seams, tufts and crevices of mattresses, box springs, bed frames and headboards; along and beneath baseboards; seams, tufts and crevices of upholstered chairs, sofas and wood furniture; floor areas under beds and couches; ceiling-wall junctures; and behind wall mounts such as mirrors and picture frames. The average amount of Suspend SC applied per apartment on the initial service was 0.9 gallon (between .25 gallon and 1.5 gallon), whereas follow-up applications typically used between .25 gallon and .5 gallon. Other bed bug-infested/prone areas were treated with Drione[®] (silica gel plus pyrethrins) or DeltaDust[®] (0.05 percent deltamethrin). Principal application sites for these dust formulations included under baseboards and carpet edges; behind outlets and switch plates; and the inner framework of couches and box springs.

of bed bug-infested mattresses, box springs, couches or other belongings. While throwing out infested items is sometimes advisable, it can be financially impractical for many residents, including many of those involved in this study. Retaining infested beds, couches, etc. further allowed us to determine if they could be successfully treated with appropriately labeled insecticides. No bed encasements were installed on mattresses or box springs while insecticide treatments were being evaluated.

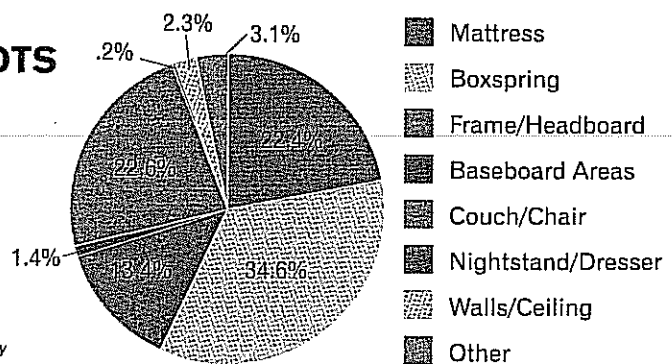
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pyrethrins) or DeltaDust[®] (0.05 percent deltamethrin). Principal application sites for these dust formulations included under baseboards and carpet edges, behind outlets and switch plates, and the inner framework of couches and box springs. Additional products used in small amounts in some apartments included CB-80 Extra[™] (0.5 percent pyrethrum), Steri-Fab (primarily alcohol plus d-phenothrin), and Invader[®]-HPX (1 percent propoxur).

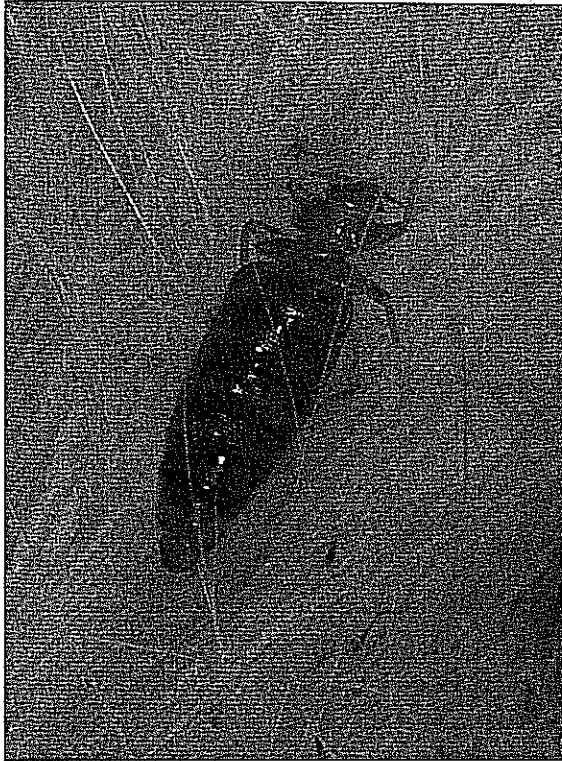
Four to six (bi-weekly) follow up inspections were made of each apartment, performing additional treatments as needed. The number of live bed bugs found in specific areas (mattress, box spring, couch, baseboard, etc.) was recorded on each

BED BUG HIDING SPOTS

Figure 2: Distribution of bed bugs found in 13 infested apartments.



Source: University of Kentucky



An adult bed bug feeding on a family dog.

service visit. (All inspections, counts and treatments were performed by the authors, primarily W. Wickemeyer.)

TREATMENT OUTCOME. Successive inspections and treatments produced a steady decline in bed bug numbers (see Figure 1 on page 47). In 10 of the 13 apartments, live bed bugs could no longer be found after two to five treatments (mean = 3.0). Three apartments, however, continued to have low-level infestations at the termination of the study due in part to poor tenant/management cooperation. Two of these tenants were suspected of reintroducing infested items while another cancelled service prematurely. Compared to the total initial number of bed bugs found in the 13 apartments, a 94 percent overall reduction was observed after two treatments, 95 percent fewer bugs were found after four treatments, and 88 percent fewer after six treatments. Excluding one unit where tenants were suspected of reintroducing infested items mid-way through the study, the decline in bed bug numbers after two, four, and six treatments, respectively, was 94 percent, 97 percent and 99 percent.

Figure 2, at right, summarizes the distribution of bed bugs found within all apartments. As expected, the greatest amount (70

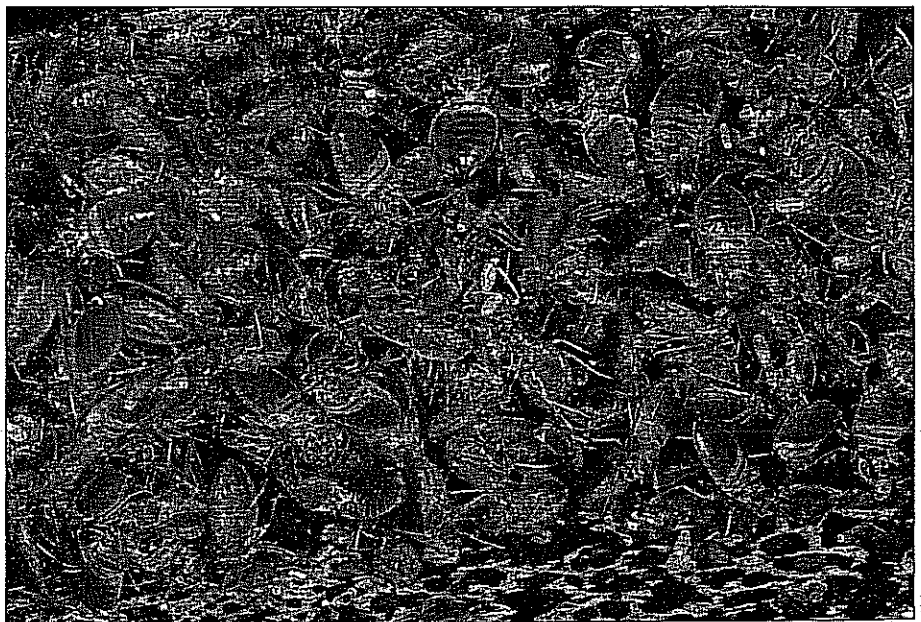
percent), were associated with beds, of which 35 percent was on box springs, 22 percent was on mattresses, and 13 percent was on bed frames and headboards. Sofas and reclining chairs harbored the next largest number (23 percent), reflecting the tendency of bed bugs to reside near a sleeping host. Couches and recliners were so bed bug-prone, in fact, that in eight out of 13 apartments they were the main location of infestation. The remaining 7 percent of the bugs were associated with walls, ceilings and baseboards; nightstands and dressers; molding and shelving, etc. Small numbers of bed bugs were also found in less obvious places, including inside books, a coffee maker, and under a deodorant dispenser. Some of these harborage sites were several feet from sleeping areas, underscoring the importance of inspecting well beyond beds.

LESSONS LEARNED. It was encouraging to see that bed bug infestations could be reduced to non-detectable levels under the challenging conditions of this study. Few infested items were discarded, and

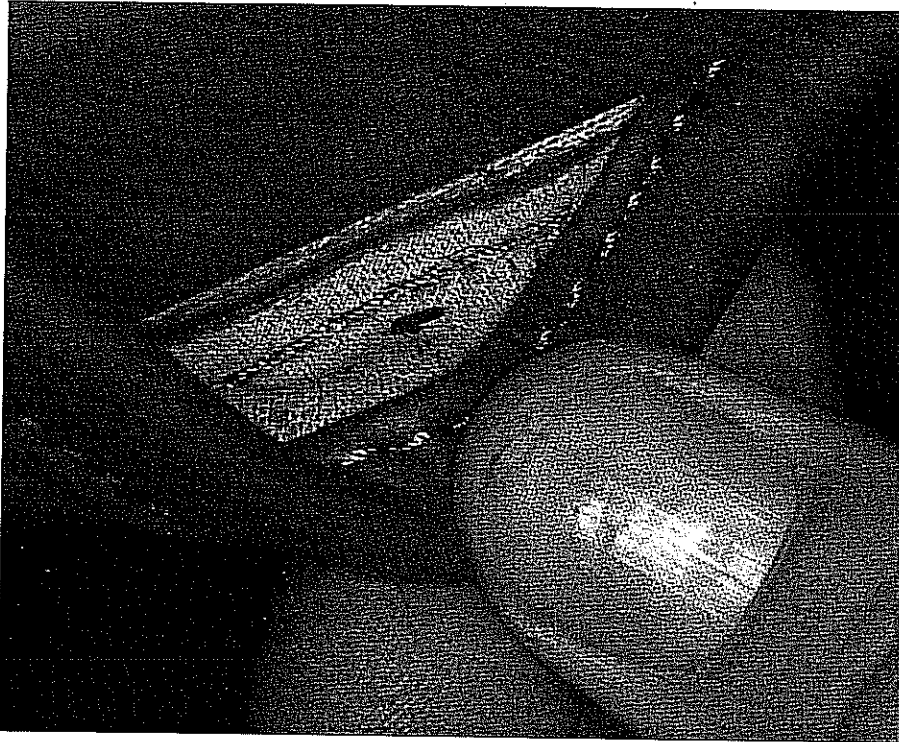
Eventually, bed bug problems may resurface, either from reintroduction of infested items, migration or survival of the pre-existing population.

other potentially useful tactics such as bed encasement, vacuum cleaning and steam treatment were not incorporated in the study.

The single most important and oft-stated lesson from this study is that bed bugs are hard to eradicate. To achieve the reported outcome, thorough inspections and repeated applications were made using quite a lot of insecticide. The amount of time spent in each apartment on the initial service ranged from one to two man-hours, with each follow-up service lasting at least an additional hour (sometimes much more). Actual time spent depended on the severity of infestation and amount of clutter and tenant cooperation. Some clients, like the one who cancelled service prematurely, will be unwilling to pay for such labor-intensive service. In these cases,



A large aggregation of bed bugs found behind a headboard.



Sofas are a common infestation site for bed bugs.

A small number of liquid insecticides such as Suspend SC have more detailed and permissible directions, including treatment of mattresses, upholstered furniture and surfaces where people may be laying or sitting.

the bed bug problem is almost certain to continue.

Even with a large investment of effort, there are no guarantees that all the bed bugs have been eliminated. No inspection, however thorough, can uncover every potential hiding place for bed bugs in a building. Young bed bug nymphs are tiny and the eggs are barely noticeable except under magnification. Following treatment, weeks or months may pass with no reports of people being bitten. Eventually though, the problem may resurface either from reintroduction of infested items, migration of bed bugs from other living units or survival of the pre-existing population. It is noteworthy that three out of the 13 apartments in our study (23 percent) continued to have small numbers of bed bugs when the trial was finally terminated three months after initial service. Other competent, hardworking pest management firms have battled bed bugs in accounts for much longer than this, indicating there is no "standard" or "guaranteed" timeframe in which infestations can be eliminated.

Why it often takes a long time to control bed bugs is unclear. Finding hidden aggre-

gations in cluttered apartments is obviously one big hurdle, but susceptibility to today's insecticides may also be a factor. On more than one occasion, bed bugs were found living on surfaces we had previously treated with residual insecticides. While it's possible these insects had not yet had sufficient time to acquire a lethal dose, another possibility is that they simply were not being affected. Further testing is underway to study this phenomenon, and susceptibility of field populations to various insecticides and methods of exposure.

More than 90 percent of the bed bugs in our study were found on bed components, couches and recliners. Ironically, these are the same places that most of today's insecticides are not to be used. Bed bugs are not listed as a target pest on many product labels, and even when they are, use directions are often vague (e.g., "apply into cracks and crevices where pests are found or normally occur"). A small number of liquid insecticides such as Suspend SC, Steri-Fab and Bedlam have more detailed and permissible directions, including treatment of mattresses, upholstered furniture and surfaces where people may be laying

or sitting.

Considering the current legal and regulatory climate, it's questionable how many products will have such liberal label directions in the future unless perhaps bed bugs become as common as in the past, which we think is quite likely. (Food for thought: in Europe in the 1930s, 47 percent of moving vans inspected were found to be infested with bed bugs).

With time, the industry will become more skilled at managing bed bug infestations, although society's intolerance of the pest and pesticides will pose many challenges. Much can be learned about the challenges we face from the past. If history repeats itself, we are in for quite a ride. ☞

All photos are courtesy of M.F. Potter

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