Bed Bugs 101
for Shelters & Supportive Housing Programs
Hosted by the
Office of Economic Opportunity
Presenters

Alan Graham is the State Entomologist and works for the Vermont Agency of Agriculture. He is frequently asked questions about bed bugs, but works with a wide variety of insects and insect problems. He developed a statewide surveillance program that surveys mosquitoes and ticks to test for vector borne diseases.

Lauren Prinzing is a CSTE Applied Epidemiology fellow working in Environmental Health and Injury Prevention at the Health Department.
Bed Bugs

Alan C. Graham
Vermont Agency of Agriculture

Overview

- General Information
- Signs of infestation
- What can you do
- Regulations
General Information

- History
- Identification
- Life History
Bed Bugs

*Cimex lectularius* L.

- Official Common Name: Bed bug
- Other unofficial names: wallpaper flounder, night crawler, red coats, wall louse, bed louse, mahogany flats, house bug, crimson ramblers and heavy dragoons (>50)

[https://identify.us.com/idmybug/bed-bugs/](https://identify.us.com/idmybug/bed-bugs/)
Medical Importance

- Naturally infected by at least 27 human pathogens
- BUT: never been proven to biologically transmit even one
- Sensitivity syndrome
- Loss of blood: 8 ounces of blood = 40,000 bed bugs
- Swallow bug - WEE
Nursery Rhyme

Good night, sleep tight
Don’t let the bed bugs bite
If they do, take your shoe
And beat them ‘til they’re black and blue’
Bed Bug History

Bedbugs were a problem in the 19th century, almost disappeared by the 1940s, but re-appeared from about 1995. Many New York City homes and stores became infested with bedbugs, as it grew to become a national problem by 2010.

The rhyme “Good night, sleep tight, don’t let the bedbugs bite” became used in the United States by the 1880s and 1890s. In some versions, “mosquitoes” did the biting. An earlier version (from the 1860s and 1870s) was

“Good night, sleep tight, wake up bright in the morning light, to do what’s right, with all your might.”

source: http://www.barrypopik.com/index.php/new_york_city/entry/
1499
Hortus Sanitatis
woodcut print

https://commons.wikimedia.org/wiki/File:Hortus_Sanitatis;_bed_bugs,_delousing._Wellcome_M0011711.jpg
Bed Bug Murder

Kills bed bugs, moths, fleas and other insects.

Bed Bugs are Terrible—They Spread Disease and Discomfort to Human Beings. BED BUG MURDER is deadly effective—Active Ingredients 100%.

Valmor Products Co.
Chicago

Worldwide distribution of bed bugs

In 2007 outbreaks reported in all 50 states

New York City has some of the most severe issues

http://bedbugregistry.com/metro/nyc/


http://bedbugregistry.com/
Bed Bugs
Recent Trends

- Pest control companies: 10-100% increase in BB jobs in Northeast
- New York City DOH:
  - 2004 = 79 inquiries
  - 2006 = 4,600
  - 2010 Management report to the Mayor

http://www.dailymail.co.uk/news/article-484900/
Bed Bugs
Why the resurgence?

- Increased Worldwide Travel

Resurgence?

- Changes in Pest Management Practices such as monthly contracts, loss of hydrocarbons

http://exopestqatar.com/img/gal/coc-spray.jpg

http://resources2.news.com.au/images/2013/12/08/1226778/285754-8216cfe2-5f93-11e3-bb71-e2c853748ae0.jpg

https://www.flickr.com/photos/crossettlibrary/5574122257
Resurgence?

- Refurbished mattresses

Bed bugs on mattress


https://c2.staticflickr.com/4/3644/3333707314_5ac39633d8_b.jpg
Resurgence?

- Economic conditions

https://commons.wikimedia.org/wiki/File:TrashyDesire.jpg

https://commons.wikimedia.org/wiki/File:(1)Banks_Avenue_public_housing.jpg

https://commons.wikimedia.org/wiki/File:Chelsea_Motel.jpg

https://www.flickr.com/photos/68593573@N00/347418257/in/photostream/
Resurgence?

- Rental Furniture
- Roadside Pickups
- Thrift Stores

https://commons.wikimedia.org/wiki/File:CommunityClosetThriftStoreItems.jpg

https://www.flickr.com/photos/pixeljones/24563726

https://www.flickr.com/photos/alanstanton/2493833576

https://commons.wikimedia.org/wiki/File:CommunityClosetThriftStoreItems.jpg
Bed Bug Identification

- Somewhat flattened
- Oval, $\frac{1}{4}''$ long, brown to reddish-brown
- Short head, broad body
- Wingless (pads)
- 4 segmented antenna
- 3 segmented piercing-sucking mouthpart resting in a grove
- Short golden colored hairs on body
Bed bugs at Various Stages of Growth

http://www.hud.gov/offices/lead/library/hhi/NCHH_Bed_Bug_Control_2-12-10_final.pdf
Bed Bug vs Bat Bug

Hair length – less than eye width
Pronotum – deeply concave

Hair length – greater than eye width
Pronotum – slightly concave

CREDIT: J. Kalisch, UNL Entomology
Complete lifecycle

Egg-egg @ 80F = 1 month
@ 64F = 4 months
Bed Bug Life Stages

- Adult laying eggs, eggs hatching
- Engorged Nymph
- Hatched Eggs

Egg close-up

Photo Credit: James Kalisch, UNL Dept of Entomology

https://c2.staticflickr.com/2/1231/4603663279_b55fa2d3fc_b.jpg

https://c2.staticflickr.com/4/3329/4603662593_538e46544c_b.jpg

https://c2.staticflickr.com/2/1231/4603663279_b55fa2d3fc_b.jpg
Bed Bug Eggs
Under favorable conditions

- 200-500 eggs/female (1-5/day)
- Prefers textured materials
- 6 – 12 days to hatch

http://www.bedbug.me/bed-bug-images
Life Stages - nymph

Can fit into an area about the thickness of a business card

Egg hatching

Expanding with internal fluids

Photo by "Louis Sorkin & Randy Mercurio, American Museum of Natural History"
Bed Bug Nymph

- 5 larval stages (instars)
- At least 1 blood meal per molt – humans but...
- 3-12 minutes/feeding
- Up to 3 months
- Primarily nocturnal

Nymph feeding

https://upload.wikimedia.org/wikipedia/commons/5/5d/Bed_bug_nymph,_Cimex_lectularius.jpg

https://www.flickr.com/photos/lou_bugs_pix/324802634
Adult

female
male

Adult

Typically lives 316 days but can live up to 18 months

https://bedbugmutts.com/bed-bug-blue/ Harold Harlan (left) and Michael Higgins (right), both of AFPMB
Bed Bugs and their Feces inside TV Stand

Credit: http://www.co.ramsey.mn.us
Signs of Infestation
Bed Bug Bites

The common bed bug (Cimex lectularius). Image: Piotr Naskrecki/CDC
Bed bug bites

http://bedbugger.com/bed-bug-bites-photos/


https://commons.wikimedia.org/wiki/File:Bedbugb2.JPG

http://hotels.about.com/od/hotelsecrets/ss/Bedbug-Bites.htm#step3
Bed Bug Detection

- Visual inspection
- Traps
- Bed Bug Dogs
Inspection

Controlling active bed bug infestations
Harborage mattress
Harborage

Screw head with eggs

Painted door hinge

Couch staples

Bottom of a slipper
Harborage

Head board

Bed slat

Canvas slat

CD shelf
Harborage

- Behind baseboard
- Running shoe
- Couch
- Bed slats
Trapping
**Detection**

**Climbup Insect Interceptor Bed Bug Trap, 4ct**
by ClimbUp

- 333 customer reviews | 25 answered questions

**List Price:** $40.00
**Price:** $14.95 & FREE Shipping on orders over $35. Details
**You Save:** $5.00 (25%)

**In Stock.**
Want it tomorrow, Feb. 13? Order within 9 hrs 49 mins and choose Saturday Delivery at checkout. Details
Sold by EverydayPure and Fulfilled by Amazon. Gift-wrap available.

- Pesticide-Free Monitor: Talc-coated monitor traps live bugs for early detection.
- Dual-Well Design: Shows you which direction bedbugs are crawling.
- Helps determine which furniture is still infested after treatment.
- Versatile Design: Fits all furniture with posts/feet 3.75 in. diameter or less.
- Box includes 4 Made in the USA interceptors.

11 new from $12.00  1 used from $12.52
Make your own traps

http://news.ifas.ufl.edu/2014/05/a-better-bedbug-trap-made-from-household-items-for-about-1/
Recycled materials

YouTube: https://www.youtube.com/watch?v=Jjc4CD4U4uQ
Bed Bug Dogs
Canine Scent Detection Dogs
Canine Scent Detection Dogs
Why use Canine Detection

1. **Less Expensive**
   Bed bug detection dogs generate *quicker* and *more accurate*

2. **Cutting Edge Technology**
   The "nose" is cutting edge technology

3. **Proven and Trusted**
   "Man's best friend" has been used for years by the military and law enforcement agencies to detect bombs and drugs, among other things.

4. **Dogs Are Honest**
   Dogs are trained to work for food and love...*and NOT* for profits.

5. **Greater Peace of Mind**
   Research supports that if the dog finds bed bugs, there is a high statistical probability that you should investigate further. If the dog doesn't find bed bugs, you can know with greater certainty that your home, office, school or business is safe.

6. **Effective Problem Solvers**
   Bed bug dogs can quickly and more accurately inspect a home.
What can you do?
Educating Residents and Staff

- Give on-site seminars
- Put up posters
- Give bed bug brochure to each resident
- Demonstrate good practice techniques
- Respond rapidly to any reports of bed bugs
Barriers to Effective Bed Bug Control

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**People**

- Limited knowledge and awareness
- Not enough money
- Lack of time
- Lack of support
- Other problems dominate
  - Desperation: people will try anything they think might help
- Norms that bed bugs are part of life
- Stigma
  - People who move/travel a lot can easily spread bed bugs
- Difficult to get help

**Situation**

- Poor problem recognition
- Lack of public financial resources
  - Low priority level
- Lack of local leadership
  - Lots of potential transfer points for the bugs
  - Lack of sufficient outreach and education
- Lack of support services
  - Lack of uniform policies (ex. landlord/tenant laws)
  - Low familiarity with the problem
  - Lack of prioritization

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http://npic.orst.edu/pest/bedbug/tacklingbbstarterguide.pdf
### Challenges to Consider

<table>
<thead>
<tr>
<th>Party</th>
<th>Potential Challenges</th>
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<tbody>
<tr>
<td><strong>Landlord</strong></td>
<td>• Non-compliance: will not treat a unit or assist residents needing help to control bed bugs.</td>
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<td>• Not educating the tenants on prevention and early notification.</td>
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<td>• Selecting a pest control operator based solely on price, rather than on experience with bed bugs and IPM programs.</td>
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<td>• Recouping treatment costs by billing the tenant.</td>
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<td>• Does not re-inspect units after infestation.</td>
</tr>
<tr>
<td><strong>Tenant</strong></td>
<td>• Non-compliance: does not report an infestation.</td>
</tr>
<tr>
<td></td>
<td>• Afraid of eviction, personal property loss, and unaware of rights.</td>
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<td>• Unable to prepare for treatment.</td>
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<td>• Unwilling to let an inspector or pest control operator into the home.</td>
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<td></td>
<td>• Attempts at DIY pest control could lead to ineffective treatment and pose human health hazards.</td>
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<td>• Clutter and lack of cooperation with pest management professional.</td>
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<tr>
<td><strong>Pest Control Operator</strong></td>
<td>• Does not employ Integrated Pest Management strategies</td>
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<td></td>
<td>• Does not effectively treat unit.</td>
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[Link](http://npic.orst.edu/pest/bedbug/tacklingbbstarterguide.pdf)
Does your business have a written Bed Bug Protocol?

Not “if” you find bed bugs, but “when” you find bed bugs

☐ What will you do?
☐ What procedures will you follow?
☐ How will you measure success?

Be Proactive not Reactive

Vermont Department of Health
Helpful Fact Sheets and Checklists

- Intake Procedures
- Avoiding Bed Bugs at Work
- Social Worker Procedures
- Room Preparation
- Cleaning and Laundry
Sample Intake Procedure Checklist

- Incorporate questions about exposure to bed bugs into medical questions asked during intake interviews. Phrase questions compassionately, such as:
  - Have you stayed in a place where you think you may have been exposed to bed bugs in the past three months?
  - Has anyone in your family been bitten by bed bugs or do they have bites or blisters that you’re concerned about?

- If exposure is indicated, immediately begin to implement facility bed bug protocol.
Sample Intake Procedure Checklist Continued

- Seal clothing and belongings inside plastic bags.
- All clothes, shoes, coats, etc. should be placed inside a HOT dryer for at least 30 minutes. Do not overstuff the dryer.
- Keep cleaned items separate from those that have not been checked or cleaned.
- All items that have not been inspected or cleaned should remain in the plastic bags.
- Provide the individual with literature about bed bugs and their management and prevention.

Vermont Department of Health
Health Department Resources

- Frequently Asked Questions about Bed Bug Safety
- Bed Bug Protection Tips
- Identification, Control and Prevention Recommendations
- Links to Additional Outside Resources
  - EPA
  - Pest Control Professionals
CONTROLS
Barriers - Encasements

Choose the correct size
Discard and Destroy

- Unsalvageable
- Plastic wraps
- Tape
- Slice Furniture
Identify Furniture

Slit with Knife or Dump Ketchup on Mattresses
The Clothes Drier is Your Friend

30 minutes on High heat

http://www.cetis.org/175/electric-clothes-dryer.html
Use a Freezer

- Bag items in plastic bags
- Freeze for 4 days at 0°F
Carbon Dioxide

For treatment of many objects that cannot be treated with heat

3 Pounds of Dry Ice per 42 gallon plastic garbage bag
Seal for 24 hours


http://www.rethinkyourwaste.com/our-garbage.html
http://www.publicdomainpictures.net/
Targeted Vacuuming

Make vacuums accessible to low-income residents
Thermal treatments

Steam

- Selective
- Cost effective
- 50 psi best
- Steam that is hot enough to kill all bed bug stages is too hot to touch
- 1 ft per 10-15 seconds
Thermal treatments

Dry Heat

- 113°F for one hour
- 104°F for 24 hours
- Potential furniture, equipment and fixture damage (sprinklers)
- Dispersal
- Advantages: no insecticide, no long vacancy etc.
How long does it take to kill bed bugs, at all stages, with heat?

From the University of Florida, slide #11 of the PowerPoint below:

100 minutes at 106F
25 minutes at 109F
4 minutes at 113F
2 minutes at 117F
1 minute at 120F

Remember that this is the temperature you need to get the bug (or egg) up to for the requisite time. So, 1 minute in a 120F dryer is likely not sufficient, you need to get every last bit of your stuff up to the desired temperature. When the thermal people bake a house, they need to run their process long enough to penetrate every last cubic inch of the home (including deep in the couch and inside the walls.)

If you less heat available, or have items that can't take high heat, you can still kill, if you give it more time.

http://ipm.ifas.ufl.edu/pdf/Oklahoma_Bed_Bug_Heat_treatment.ppt
Cold

- BB can tolerate 5°F
- Eggs are more tolerant
- Chest freezer @ -20°F for 10 hours
- 0°F for at least 4 days
- Spot Cold Treatment

Cryonite system
Bed Bug Research

- Interceptor Bed Bug Traps can be very effective with low level infestations.

- Carbon dioxide, used as an attractant, can increase sensitivity of trapping.
  - See publications of Changlu Wang, Rutgers University.
  - [http://entomology.rutgers.edu/personnel/changlu-wang/publications.html](http://entomology.rutgers.edu/personnel/changlu-wang/publications.html)
Monitor with bed bug traps
Chemical Control

- Misuse of pesticides can be dangerous
- Pesticide resistance issues
- Let professionals do the treatment

Discourage residents from using pesticides
Regulations
Vermont Rental Housing Code

- Definition

“Infestation means the presence of any pest or bedbug that creates a health hazard or other risk to the preservation of public health.”
Vermont Rental Housing Code

6.1 Owner Responsibilities:

6.1.1 The owner of a dwelling shall maintain all common spaces free from infestation.

6.1.2 The owner of a dwelling shall be responsible for extermination of infestation in all common spaces.

“common spaces”
6.1.3 The owner of a dwelling shall be responsible for extermination of any infestation in any dwelling unit when infestation in a dwelling unit is caused by his or her failure to maintain the dwelling or infestation exists in two or more of the dwelling units in any dwelling.
Vermont Rental Housing Code

6.1.4 The owner of a rooming house shall maintain all rooming units and common spaces free from infestation and shall be responsible for extermination.
6.2 Occupant Responsibilities: The occupant of each dwelling unit shall maintain that part of the dwelling he or she exclusively occupies free from infestation and shall be responsible for extermination when the infestation is caused by his or her failure to maintain the dwelling unit except as provided for in Section 6.1.3.
6.3 Extermination of Pest Animals and Bedbugs: Extermination shall be accomplished by eliminating the harborage place of pests and bedbugs, by removing or making inaccessible materials that may serve as their food or breeding ground and by treatments including but not limited to poisoning, spraying, fumigating, heat treating, or trapping.
REMEMBER

Dispersal is entirely passive
Don’t bring them home!

- Assume beds, furniture etc. are infested
- Avoid laying across, leaning against, sitting on furniture
- Minimize direct contact with drapes, rugs, piles of dirty clothes
- Take off your clothes, place in plastic bags, launder in hot water and hot drier
What you can do

- Look for hard sitting surfaces during visits
- Pay attention to where you place bag and coat
- Keep your bag simple and zipped closed
- Treat work clothes carefully after visit
- Use large plastic bags to carry clothing
- Use your clothes drier at home
- Carry Spray Bottle of Alcohol

Don’t Bring Bed Bugs Home
Thermal Heat Tents

- Portable Heat Units
- Wrap in black plastic: doesn’t work
Carry Spray Bottle of Alcohol

**ISOPROPYL ALCOHOL SPRAY IN 2 OZ. BOTTLE**

Cools and cleanses cuts and abrasions. Active ingredient Isopropyl Alcohol 70% helps decrease risk of bacterial infection from cuts, scrapes and bites. Shelf life: 3 years from date of manufacture.

Item ALS2-24

Case Pack: 24 pcs. per case
Case Weight: 4.7 lbs.
Case Cube: .17 cu. ft.
Case Size: 8.75in. x 6in. x 5.5in. (20.75 x 15 x 13 cm)

[MSDS Sheet][Product Sheet]
Questions?
Contact Information

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Links to Helpful Resources

- General Information: http://vdh-stage.hark.bz/health-environment/healthy-homes/pests-and-bed-bugs

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