



# Bed Bugs 101

for Shelters & Supportive Housing Programs

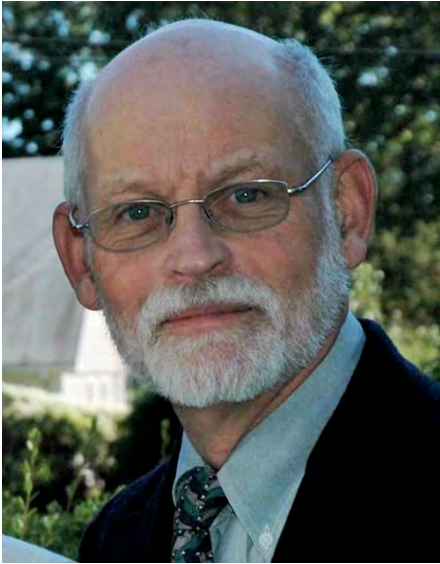
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Hosted by the  
Office of Economic Opportunity



# Presenters

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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



<https://phil.cdc.gov/phil/details.asp?pid=9822>

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/>

# 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

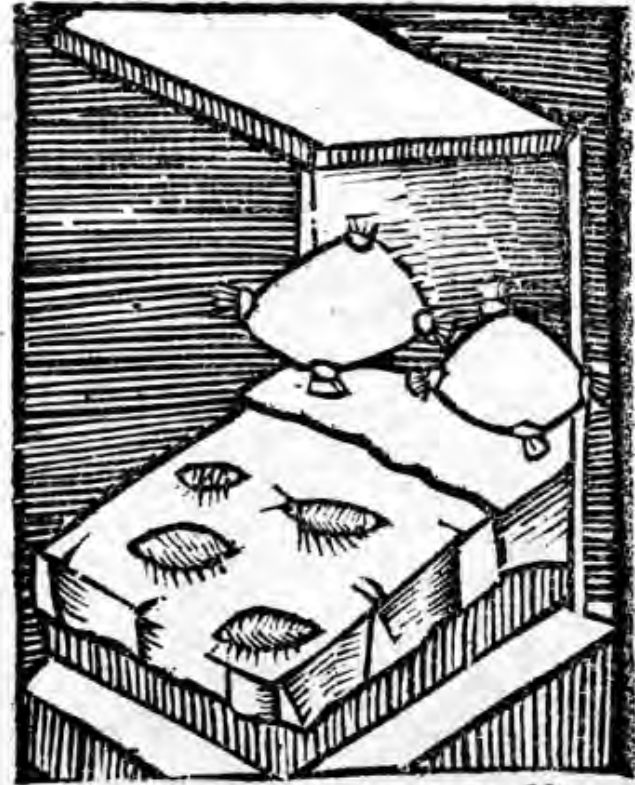
“Good night, sleep tight, wake up bright in the morning light, to do what’s right, with all your might.”

source: [http://www.barrypopik.com/index.php/new\\_york\\_city/entry/](http://www.barrypopik.com/index.php/new_york_city/entry/)



# 1499 Hortus Sanitatis woodcut print

peruenit ad etatem .Iii.li.viij. Circa aut pul-  
lum equinū hoc vltimo animaduertas: qz pas-  
sum suauem vel durum quem assuescit in iuue-  
tute vix potest dimittere etiam in senectute &c  
Superius in ca. liiij. dictum est. quare ibidem  
vide de Equo.



## Capitulum. cxviiij

**P**ulex. Ex li. de na. re. Pulices vocati  
sunt eo qz in puluere magis nutriunt.  
Pater pulicē esse vermiculū nigrū &  
minutū quidem. sed valde pungitiuū. maxime  
autē tempore estiuo et pluuiali. Saluunt autē rō

# VALMOR

REG. U.S. PAT. OFF.

## 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%

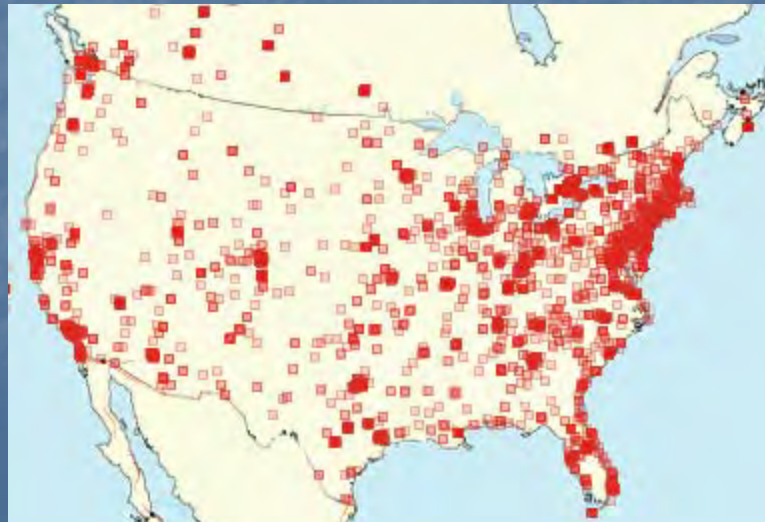
**VALMOR PRODUCTS CO.**  
CHICAGO

# Worldwide distribution of bed bugs



[http://www.domyownpestcontrol.com/all-about-bed-bugs-c-39\\_622.html](http://www.domyownpestcontrol.com/all-about-bed-bugs-c-39_622.html)

In 2007  
outbreaks  
reported in  
all 50  
states



<http://bedbugregistry.com/>

New York City has  
some of the most  
severe issues



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

# 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?



[https://commons.wikimedia.org/wiki/File:Boeing\\_707-321B\\_N421PA\\_Pan\\_American\\_World\\_Airways\\_\(Pan\\_Am\).jpg](https://commons.wikimedia.org/wiki/File:Boeing_707-321B_N421PA_Pan_American_World_Airways_(Pan_Am).jpg)

- Increased Worldwide Travel

# Resurgence?

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



<https://www.flickr.com/photos/crossetlibrary/5574122257>



<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>

# Resurgence?

- Refurbished mattresses



<http://www.vajunkremoval.com/mattress-removal.html>



Bed bugs on mattress

[https://c2.staticflickr.com/4/3644/3333707314\\_5ac39633d8\\_b.jpg](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:(1)Banks_Avenue_public_housing.jpg)



[https://commons.wikimedia.org/wiki/File:Chelsea\\_Motel.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://www.flickr.com/photos/alanstanton/2493833576>



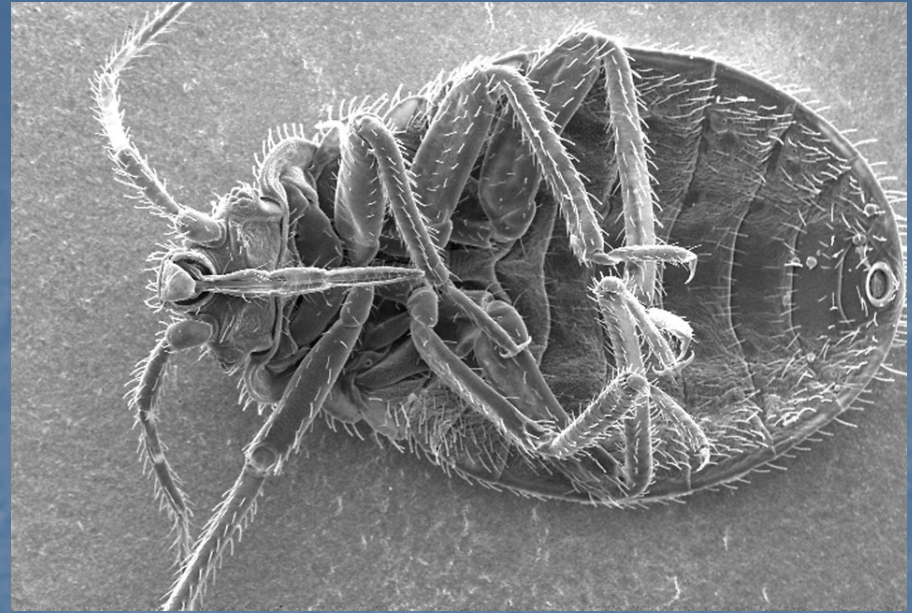
<https://www.flickr.com/photos/pixeljones/24563726>



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

# Bed Bug Identification

- Somewhat flattened
- Oval, 1/4" long, brown to reddish-brown
- Short head, broad body
- Wingless (pads)
- 4 segmented antenna
- 3 segmented piercing-sucking mouthpart resting in a groove
- Short golden colored hairs on body



<http://res.freestockphotos.biz/pictures/16/16709-microscopic-bedbug-scanning-electron-micrograph-pv.jpg>



<https://www.flickr.com/photos/usdagov/8532394624>

# Bed bugs at Various Stages of Growth



# Bed Bug vs Bat Bug



Hair length – less than eye width  
Pronotum – deeply concave

Hair length – greater than eye width  
Pronotum – slightly concave

# Complete lifecycle



Egg-egg @ 80F = 1 month  
@ 64F = 4 months

# Bed Bug Life Stages



Egg close-up

Photo Credit: James Kalisch, UNL Dept of Entomology



Phil Pellitteri, University of Wisconsin  
Department of Entomology

Adult laying eggs, eggs hatching



Engorged Nymph

[https://c2.staticflickr.com/4/3329/4603662593\\_538e46544c\\_b.jpg](https://c2.staticflickr.com/4/3329/4603662593_538e46544c_b.jpg)



Hatched Eggs

[https://c2.staticflickr.com/2/1231/4603663279\\_b55fa2d3fc\\_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





# Life Stages - nymph

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

Egg hatching



Expanding with internal fluids



<https://www.chemtecpest.com/images/bed-bug-gallery/bed-bug.jpg>



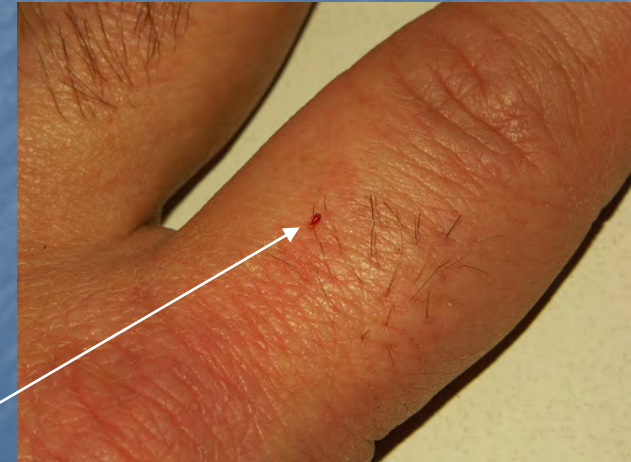
Photo by "Louis Sorkin & Amp; Randy Mercurio, American Museum of Natural History"

# 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



[https://upload.wikimedia.org/wikipedia/commons/5/5d/Bed\\_bug\\_nymph,\\_Cimex\\_lectularius.jpg](https://upload.wikimedia.org/wikipedia/commons/5/5d/Bed_bug_nymph,_Cimex_lectularius.jpg)



Nymph feeding

[https://www.flickr.com/photos/lou\\_bugs\\_pix/324802634](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/>



<http://www.bed-bugs-handbook.com/bed-bugs-bites.html>



<https://commons.wikimedia.org/wiki/File:Bedbug2.JPG>



<http://hotels.about.com/od/hotelsecrets/ss/Bedbug-Bites.htm#step3>

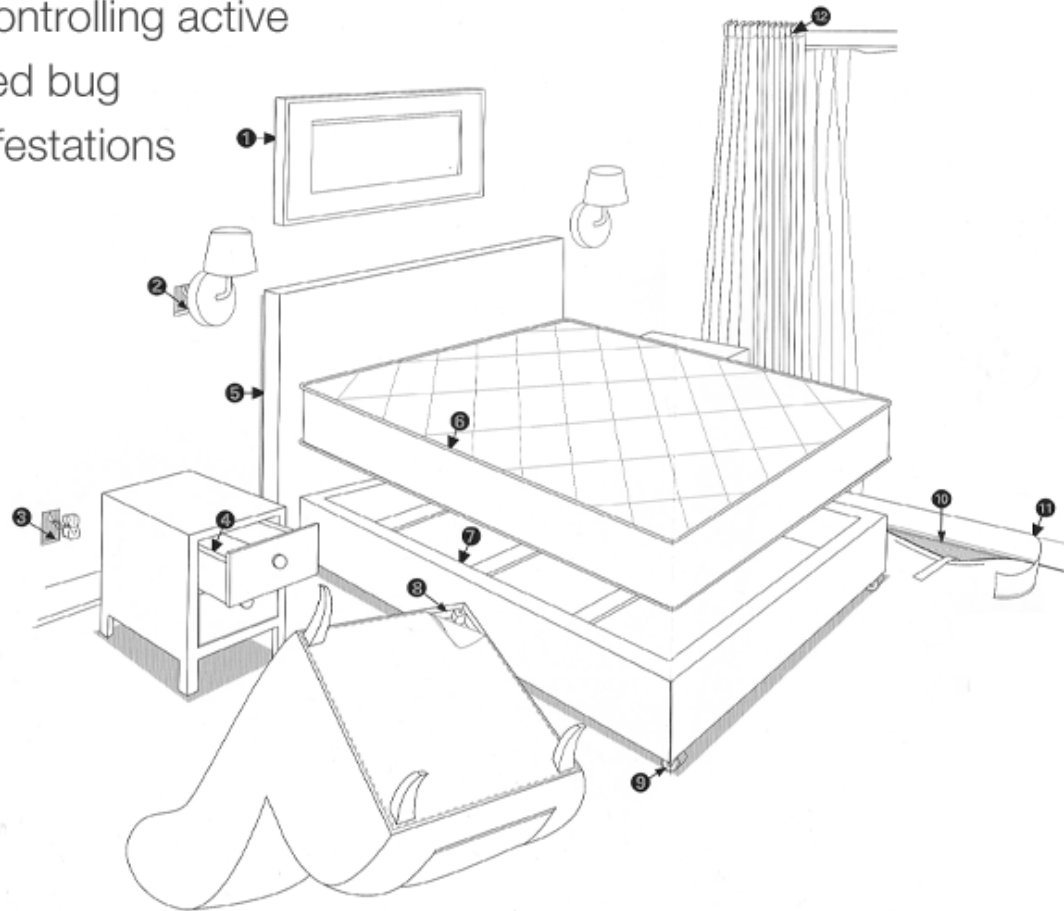


# Bed Bug Detection

- Visual inspection
- Traps
- Bed Bug Dogs

# Inspection

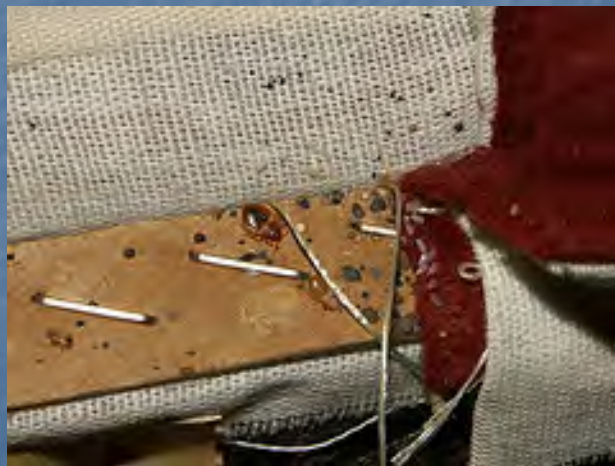
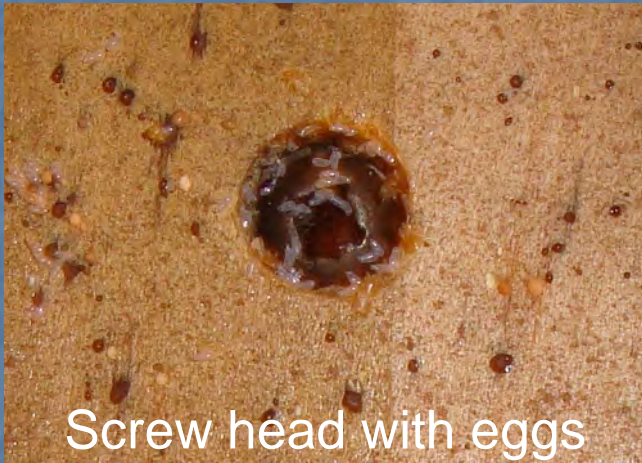
Controlling active  
bed bug  
infestations



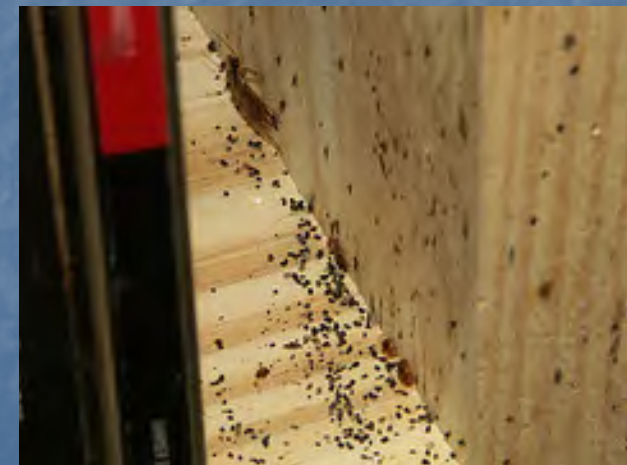
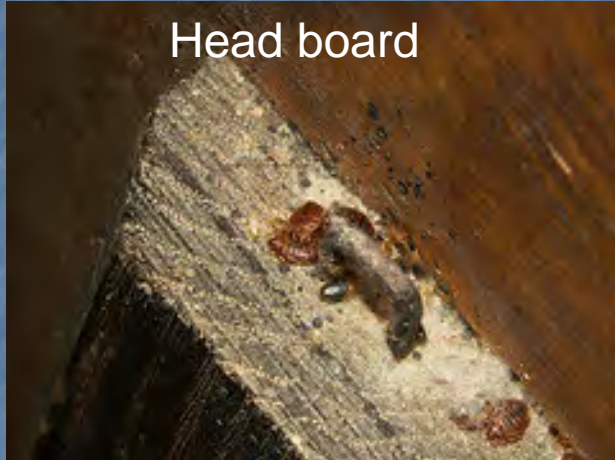
# Harborage mattress



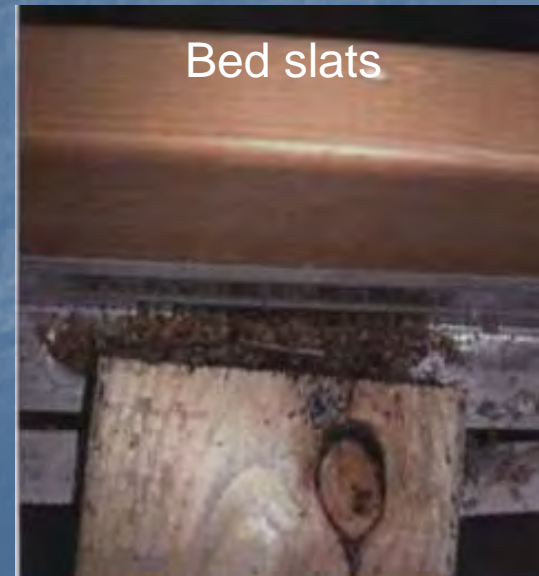
# Harborage



# Harborage



# Harborage



# Trapping



# Detection

## Climbup Insect Interceptor Bed Bug Trap, 4ct

by ClimbUp

★★★★☆ • 333 customer reviews | 25 answered questions

List Price: ~~\$40.05~~

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.

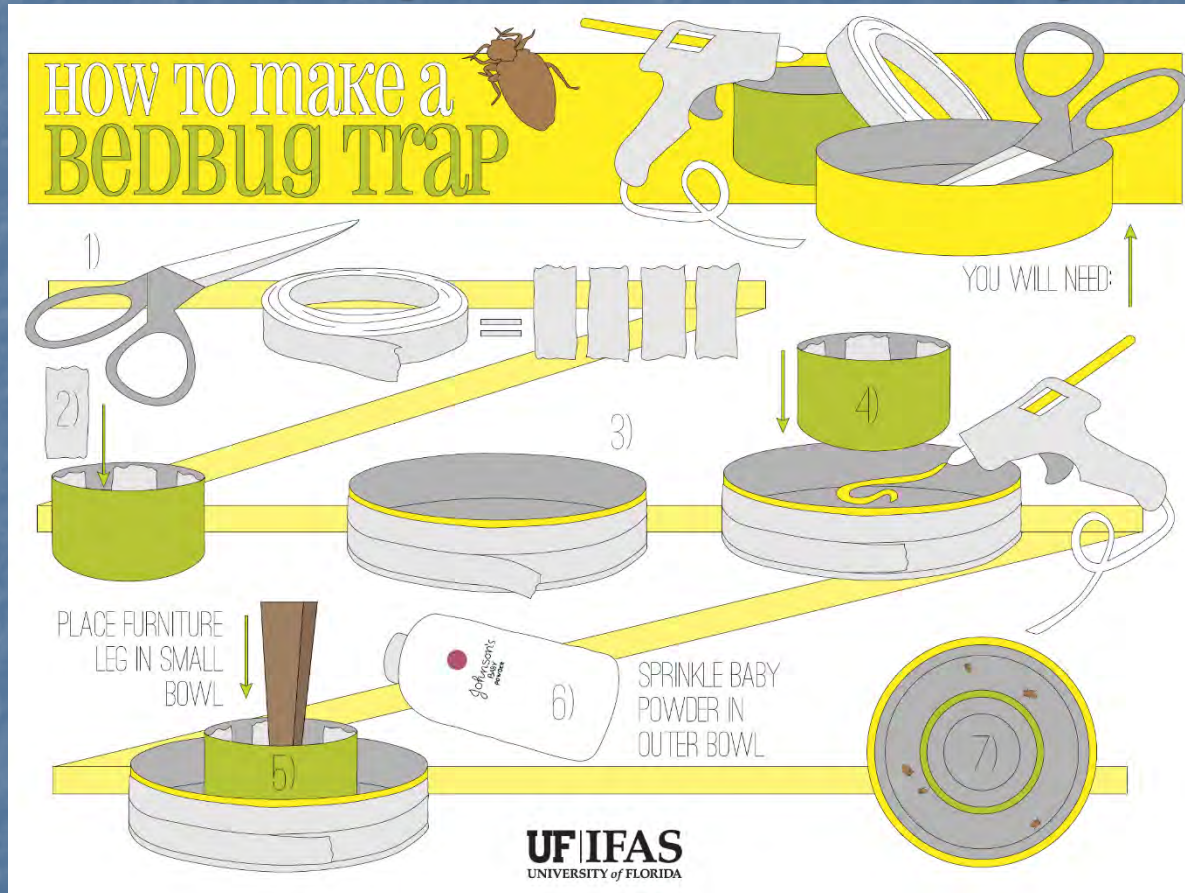
- Pesticide-Free Monitor: Talc-coated monitor traps live bugs for early detection.
- Dual-Well Design: Shows you which direction bedbugs are crawling.
- Helps determine which furniture is still infested after treatment.
- Versatile Design: Fits all furniture with posts/feet 3.75 in. diameter or less.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



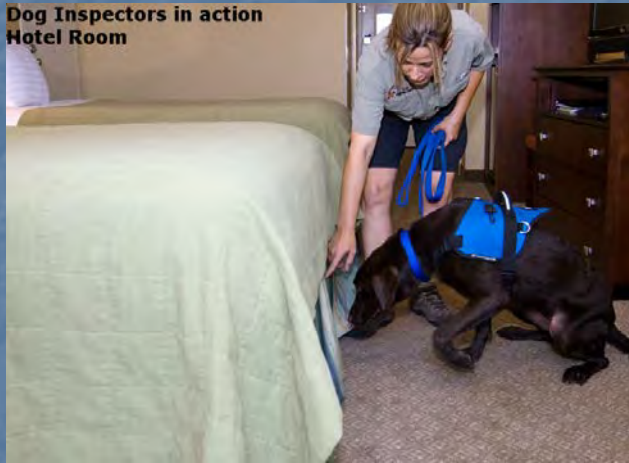
YouTube: <https://www.youtube.com/watch?v=Jjc4CD4U4uQ>

# Bed Bug Dogs



# Canine Scent Detection Dogs

Dog Inspectors in action  
Hotel Room



# 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?

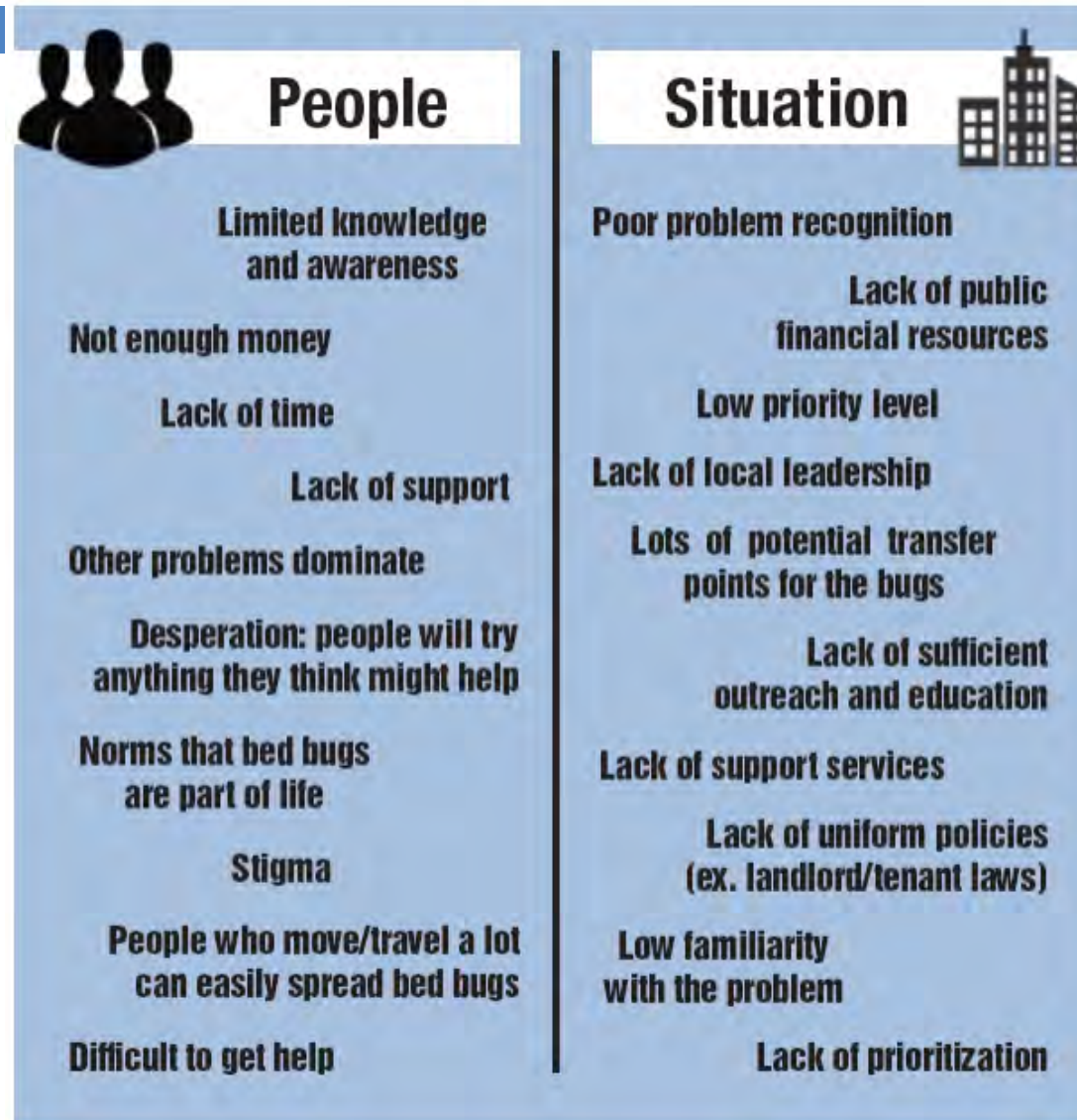


# Educating Residents and Staff

- 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



# Challenges to Consider

Party	Potential Challenges
<b>Landlord</b>	<ul style="list-style-type: none"><li>• Non-compliance: will not treat a unit or assist residents needing help to control bed bugs.</li><li>• Not educating the tenants on prevention and early notification.</li><li>• Selecting a pest control operator based solely on price, rather than on experience with bed bugs and IPM programs.</li><li>• Recouping treatment costs by billing the tenant</li><li>• Does not re-inspect units after infestation</li></ul>
<b>Tenant</b>	<ul style="list-style-type: none"><li>• Non-compliance: does not report an infestation</li><li>• Afraid of eviction, personal property loss, and unaware of rights</li><li>• Unable to prepare for treatment</li><li>• Unwilling to let an inspector or pest control operator into the home</li><li>• Attempts at DIY pest control could lead to ineffective treatment and pose human health hazards</li><li>• Clutter and lack of cooperation with pest management professional</li></ul>
<b>Pest Control Operator</b>	<ul style="list-style-type: none"><li>• Does not employ Integrated Pest Management strategies</li><li>• Does not effectively treat unit</li></ul>

<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**



# 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.



# 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

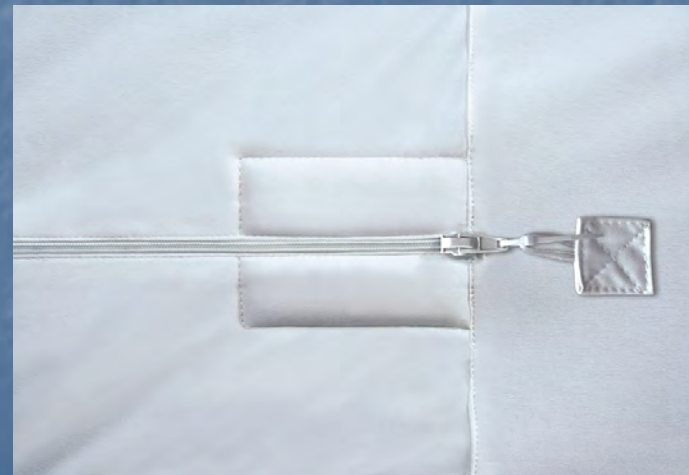




# Barriers - Encasements



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



<http://www.cetis.org/175/electric-clothes-dryer.html>

30 minutes on High heat

# Use a Freezer

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



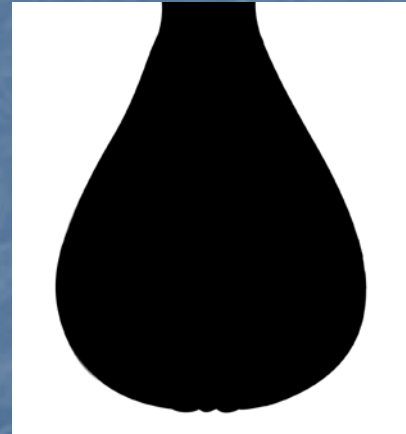
# Carbon Dioxide

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/>

Wang C. 2012. Carbon dioxide fumigation for controlling bed bugs. *J. Med Entomol.* 49(5):1076-83

# 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

- 113F for one hour
- 104F 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](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>

# 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"

# Vermont Rental Housing Code

- 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.

# Vermont Rental Housing Code

- 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.

# Vermont Rental Housing Code

- 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](#)

[View as HTML](#)

Questions?



# Contact Information

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Burlington, VT 05402

Phone: 802-652-4175

Email: [lauren.prinzing@partner.vermont.gov](mailto:lauren.prinzing@partner.vermont.gov)

# Links to Helpful Resources

- General Information: <http://vdh-stage.hark.bz/health-environment/healthy-homes/pests-and-bed-bugs>
- Homeowners FAQ: [http://vdh-stage.hark.bz/sites/default/files/documents/2016/11/ENV\\_HH\\_BedBugs\\_homeowners.pdf](http://vdh-stage.hark.bz/sites/default/files/documents/2016/11/ENV_HH_BedBugs_homeowners.pdf)
- Hospitality FAQ: [http://vdh-stage.hark.bz/sites/default/files/documents/2016/11/ENV\\_HH\\_BedBugs\\_hospitality.pdf](http://vdh-stage.hark.bz/sites/default/files/documents/2016/11/ENV_HH_BedBugs_hospitality.pdf)
- Shelters & Group Living Facilities PDF: [http://vdh-stage.hark.bz/sites/default/files/documents/2016/11/ENV\\_HH\\_BedBugs\\_shelters.pdf](http://vdh-stage.hark.bz/sites/default/files/documents/2016/11/ENV_HH_BedBugs_shelters.pdf)
- Schools FAQ: [http://vdh-stage.hark.bz/sites/default/files/documents/2016/11/ENV\\_HH\\_BedBugs\\_schools.pdf](http://vdh-stage.hark.bz/sites/default/files/documents/2016/11/ENV_HH_BedBugs_schools.pdf)
- Town Health Officers FAQ: [http://vdh-stage.hark.bz/sites/default/files/documents/2016/11/ENV\\_HH\\_BedBugs\\_THOs.pdf](http://vdh-stage.hark.bz/sites/default/files/documents/2016/11/ENV_HH_BedBugs_THOs.pdf)
- Policy and Protocol Ideas: <http://www.woodgreen.com/OurOpportunities/AllAboutBedBugs.aspx>
- “Anyone Can Get Them” Poster: [http://www.woodgreen.org/Portals/0/PDFs/WG\\_BB\\_TenantManual.pdf](http://www.woodgreen.org/Portals/0/PDFs/WG_BB_TenantManual.pdf)
- Connecticut Coalition Against Bed Bugs: <http://www.ct.gov/caes/cwp/view.asp?a=2826&q=437580&caesNav=1>
- Tackling Bed Bugs - A Starter Guide for Local Governments: <http://npic.orst.edu/pest/bedbug/tacklingbbstarterguide.pdf>

# Disclosure



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