

OSU Webinar I

Bed Bugs: Know Your Enemy

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National Institute
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Agriculture

Bed Bugs: Know Your Enemy

What will you learn today?



The growing bed bug problem



How to recognize bed bugs and their tell-tale signs



Biological characteristics of bed bugs



Some health effects due to bed bugs



How to protect oneself from bed bugs



Some questions to ask clients who suspect that they have bed bugs



Useful resources on bed bugs



Worldwide Resurgence of Bed Bugs Since Late 1990s



Aumenta la presencia de chinches en Barcelona

SPAIN

Las empresas de control de plagas descartan su desaparición y han incrementado las actuaciones contra estos insectos en

★★★★★ 10 votos | 42 comentarios

mardi 26 octobre 2010 à 18H38

Montréal: épidémie de punaises de lit confirmée

CANADA

THE TIMES
THE SUNDAY TIMES

Archive Article

Please enjoy this article from The

From The Times

April 14, 2004

Bedbugs invade London's

By Valerie Elliott, Consumer Editor

LONDON'S smartest hotels are among a string of residential properties throughout the country which are facing an infestation of "super" bedbugs. The numbers of bloodsucking bugs have increased tenfold in a decade and pest control experts have commissioned a study to identify the cause of the invasion.

ENGLAND

guardian.co.uk

Bed bugs eat into tourism

Bernard O'Riordan in Sydney
The Guardian, Wednesday 6 April 2005 01.43 BST

[A larger image](#)

The saying "don't let the bed bugs bite" has taken on new significance for Australia's burgeoning backpacker industry, which is facing an epidemic of the bloodsucking insects. The bugs, which can survive for months without feeding and are renowned as hitchhikers, travelling the world hidden in luggage, shoes and clothing, could cost the country's tourism industry tens of millions of pounds after they were found to have infested eight out of 10 backpacker hostels in Sydney's eastern suburbs alone. Many bedsits, particularly at Bondi Beach and Kings Cross, rely almost exclusively on British and Irish customers.

AUSTRALIA



inefficaces, la
éliminateurs.
sont pas

gagent



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Some Reasons For the Resurgence of Bed Bugs

- International travel and commerce
- Housing with high tenant turnover
- Pesticide use has changed
 - Pesticide bans
 - Failure to re-register insecticides
 - Baits to control ants & cockroaches
- Insecticide resistance





The Most Bed Bug-Infested Cities in the U.S.: 2016-2017

Orkin Releases New Top 50 Bed Bug Cities List

(1 Dec 2015-30 Nov 2016)

1. Baltimore (+9)
2. Washington, D.C. (+1)
3. Chicago (-2)
4. New York
5. Columbus, Ohio
6. Los Angeles (-4)
7. Detroit
8. Cincinnati
9. Philadelphia (-3)
10. San Francisco-Oakland-San Jose (+4)
11. Richmond-Petersburg, Va. (-2)
12. Raleigh-Durham, N.C. (-1)
13. Cleveland-Akron-Canton, Ohio (-1)
14. Indianapolis (+1)
15. Dallas-Ft. Worth (-2)

Cleveland Tops Terminix's Newest 'Top 20 Bed Bug Cities' List

(1 Jan 2017-30 June 2017)

1. Cleveland, Ohio
2. Cincinnati, Ohio
3. Detroit, Mich.
4. Las Vegas, Nev.
5. Denver, Colo.
6. Houston, Texas
7. Phoenix, Ariz.
8. Indianapolis, Ind.
9. Oklahoma City, Okla.
10. Philadelphia, Pa.

OSU's Ohio Statewide Bed Bug Surveys (2011 and 2016)

Survey regarding bed bug-related issues
emailed or mailed to pest management
companies and individuals licensed
(category 10A) to treat for bed bugs in Ohio

– 2011 survey

- Response Rate = $225/632 = 35.6\%$

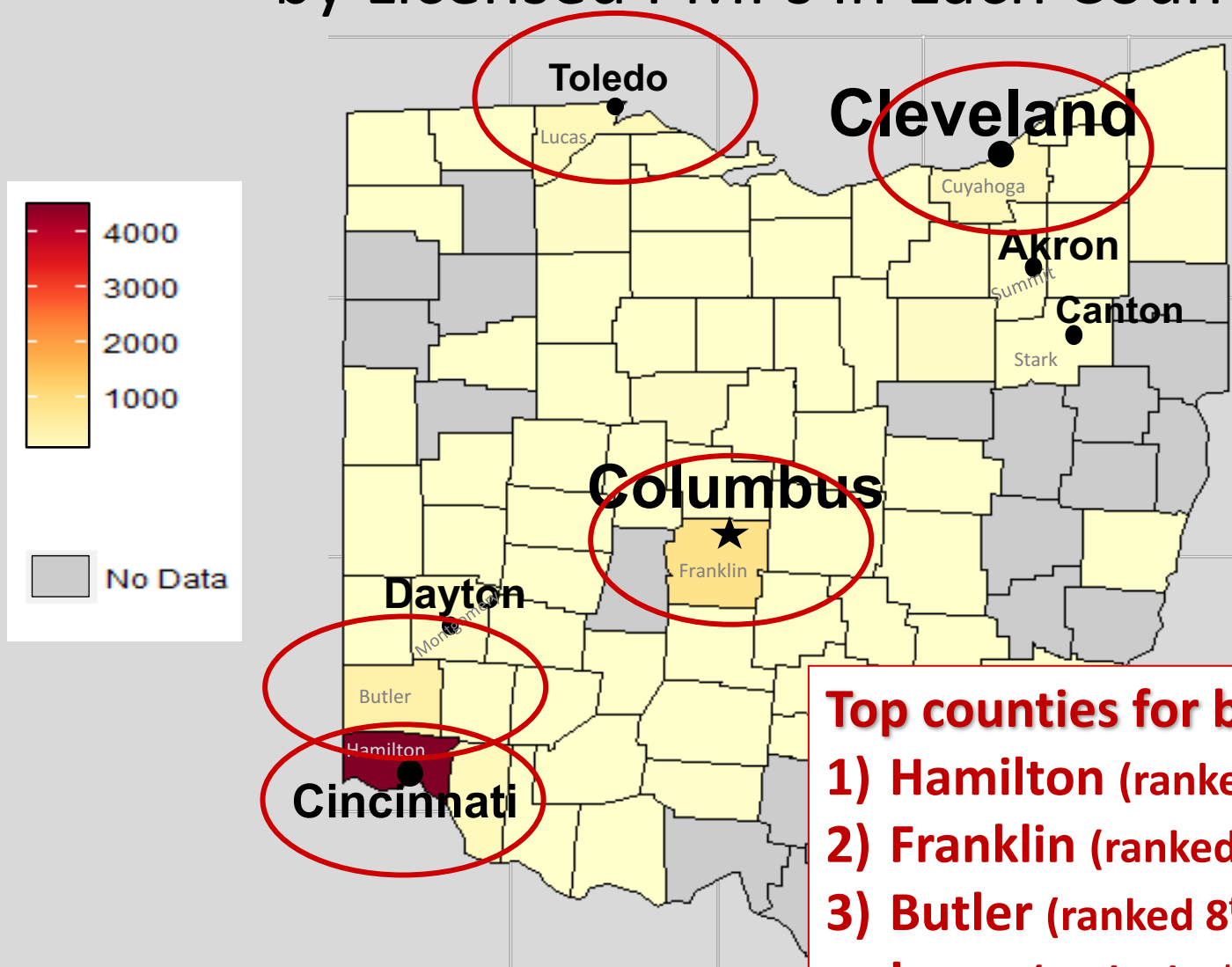
– 2016 survey

- Response Rate = $329/1041 = 31.6\%$



Estimated Total Number of Bed Bug Treatments by Licensed PMPs in Each County

2005



Top counties for bed bugs:

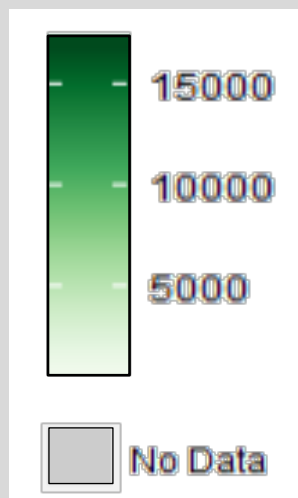
- 1) Hamilton (ranked 3rd in pop. size)
- 2) Franklin (ranked 2nd in pop. size)
- 3) Butler (ranked 8th in pop. size),
Lucas (ranked 6th in pop. size),
Cuyahoga (ranked 1st in pop. size),



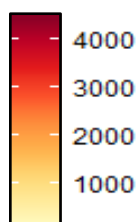
Estimated Total Number of Bed Bug Treatments by Licensed PMPs in Each County

2011

4-5X higher
than 2005 scale



2005



Top counties for bed bugs:

- 1) Franklin (2nd in pop. size)
- 2) Hamilton (3rd in pop. size)
- 3) Montgomery (5th in pop. size)
- 4) Butler (8th in pop. size)
- 5) Cuyahoga (1st in pop. size)

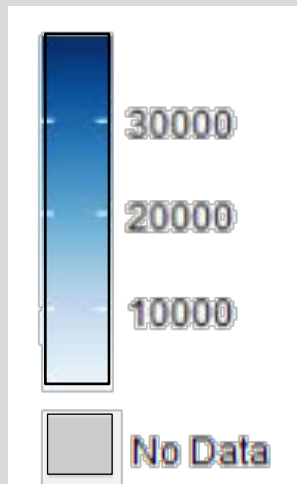


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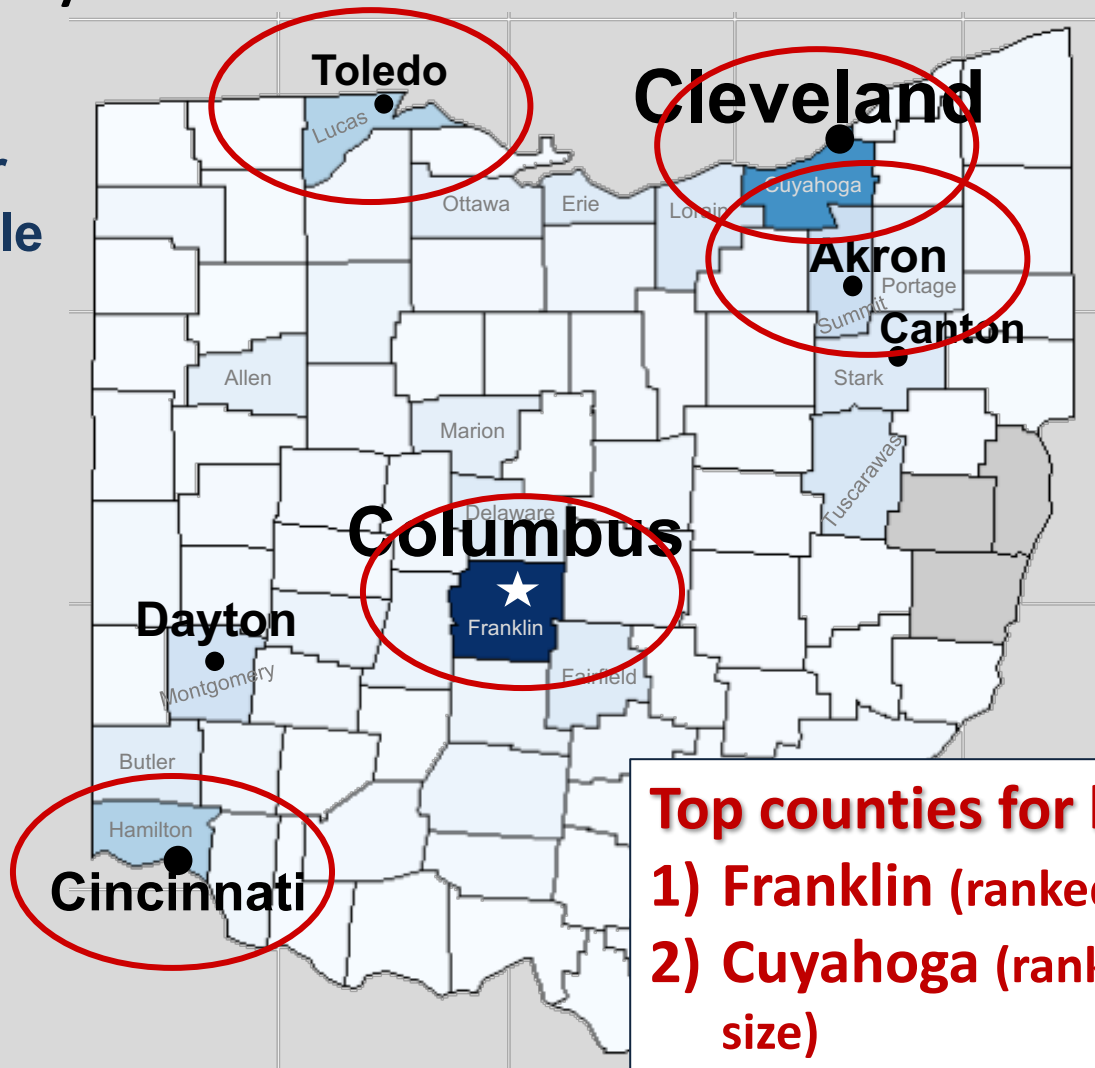
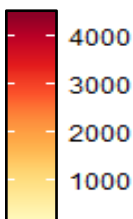
Estimated Total Number of Bed Bug Treatments by Licensed PMPs in Each County

2016

8-10X higher
than 2005 scale



2005



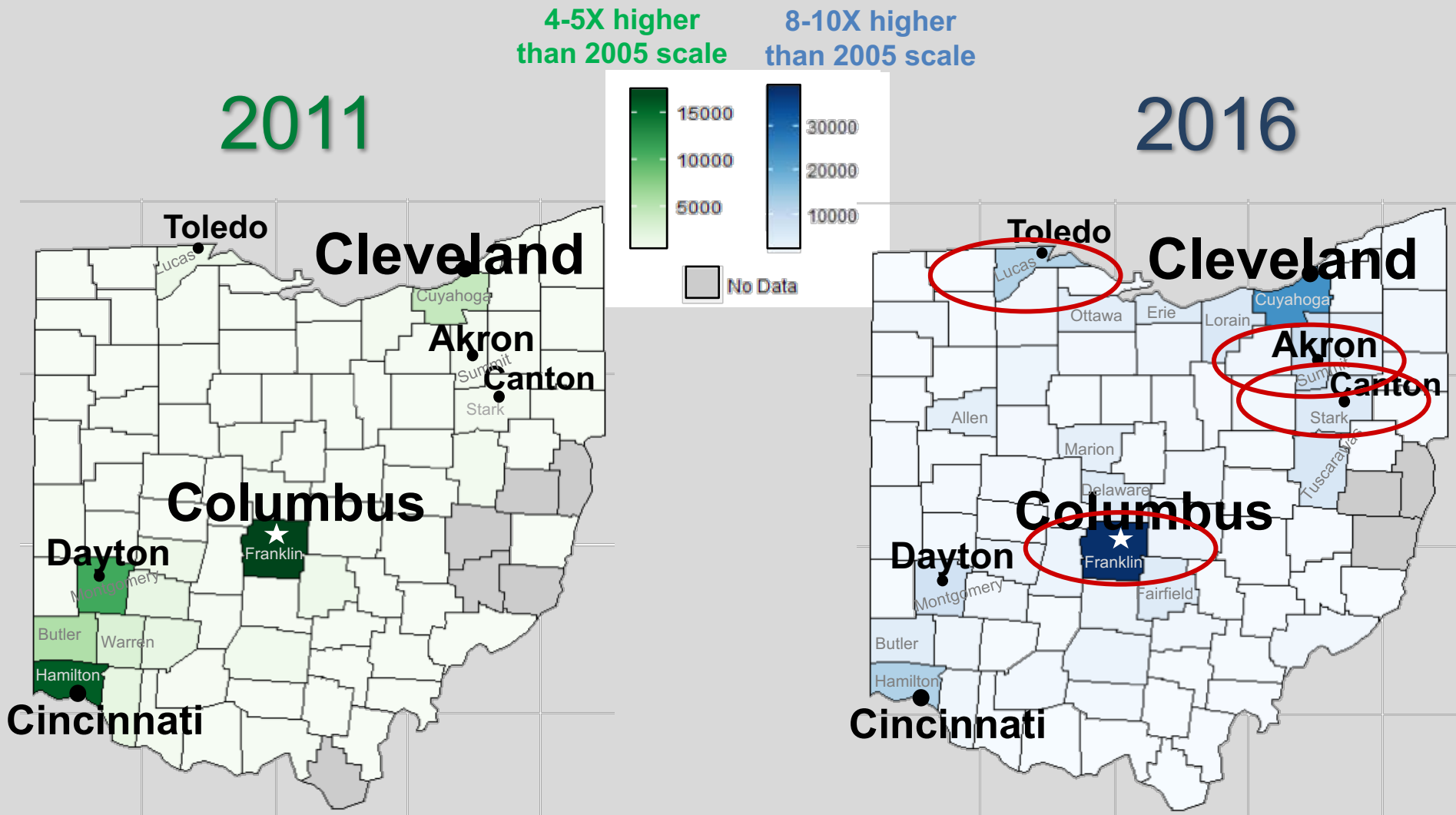
Top counties for bed bugs:

- 1) Franklin (ranked 2nd in pop. size)
- 2) Cuyahoga (ranked 1st in pop. size)
- 3) Lucas (ranked 6th in pop. size)
- 4) Hamilton (ranked 3rd in pop. size)

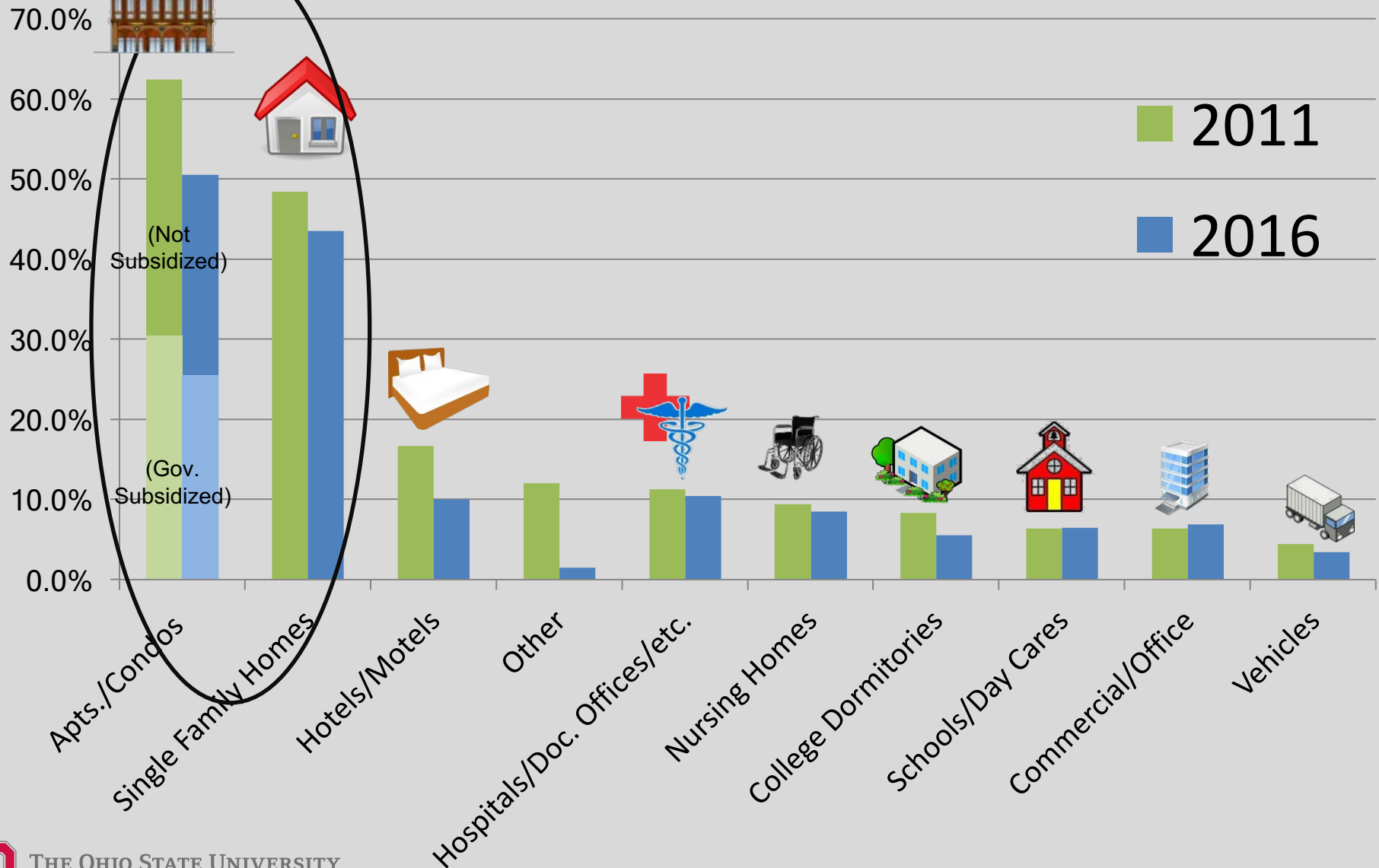


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In the 9 most populated counties, the number of treatments per person showed an increasing trend from 2011 to 2016, with a faster increase in Franklin, Summit, Stark, and Lucas counties.



Residences made up the largest share of bed bug work, especially multi-unit residences.



The Bed Bug (*Cimex lectularius*)

(Hemiptera: Cimicidae)



Insects (true bug)



Live indoors



Typically feed at night



Feed only on blood

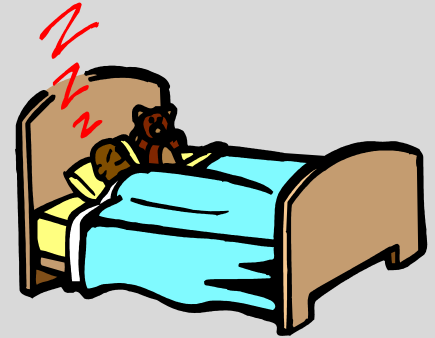
- Prefer to feed on humans

- Alternate hosts:

rodents, bats, birds, pets (cats, dogs, etc.)



Cause significant economic, physical, & mental distress



Not caused by bad housekeeping!!
BED BUGS CAN HAPPEN TO ANYONE!

INTEGRATED PEST MANAGEMENT (IPM) PROCEDURES :

Correctly identify the pest

+

Conduct a thorough inspection

+

Use sanitation measures

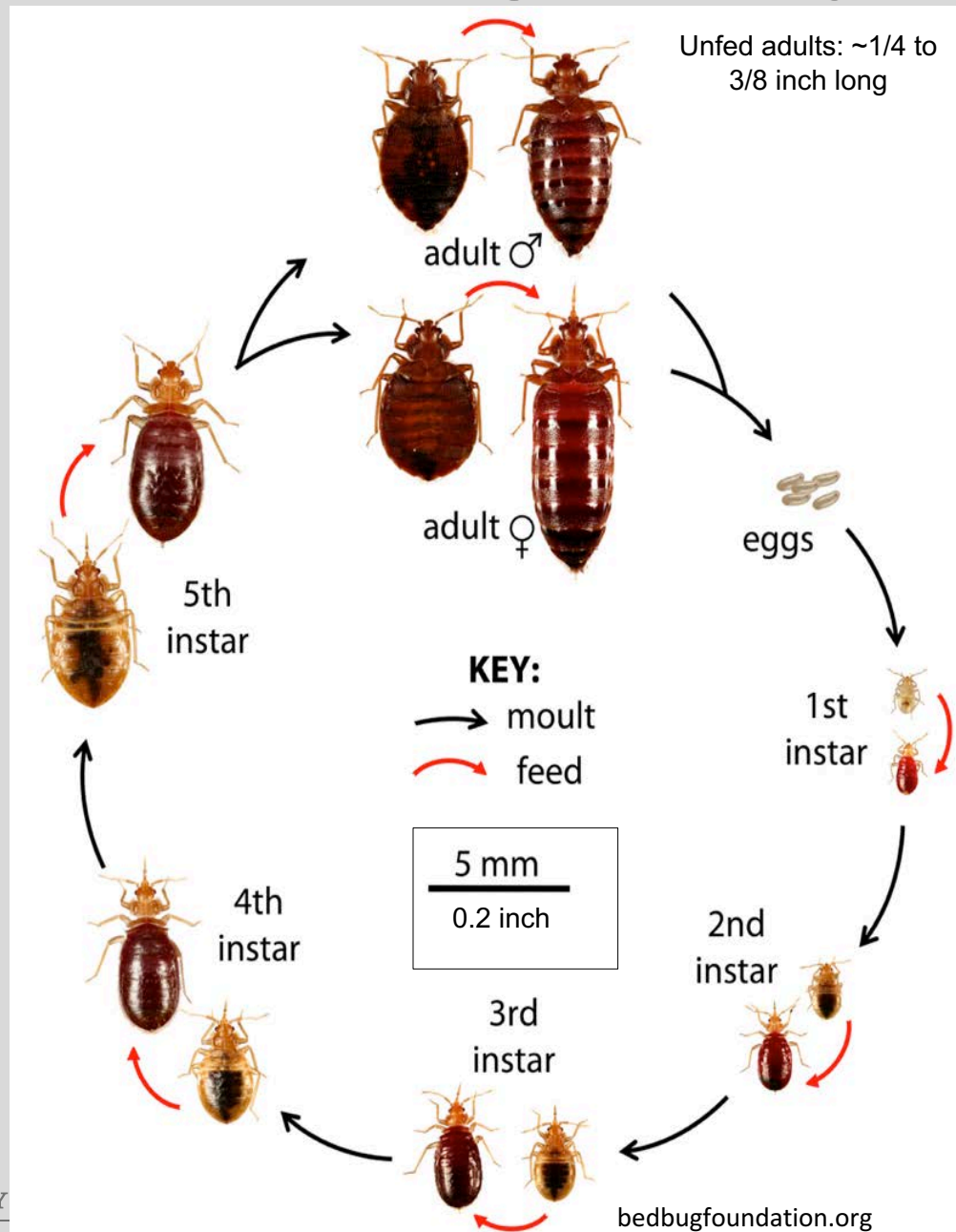
+

Use non-chemical measures

+

Apply insecticides to targeted sites

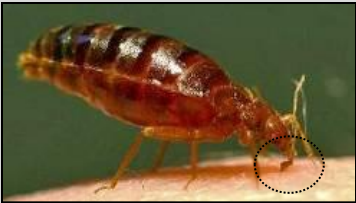
The Bed Bug Life Cycle



How to recognize if it's a bed bug:

Shape and Size

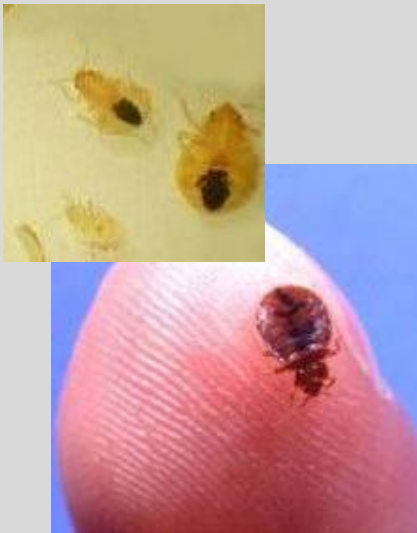
- Oval-shaped body
- Body flattened (unfed) to swollen (recently fed)
- Adults: ~1/4 to 3/8 inch long
- Youngest nymphs (immature bugs) are tiny (<<1/10 inch long)



How to recognize if it's a bed bug:

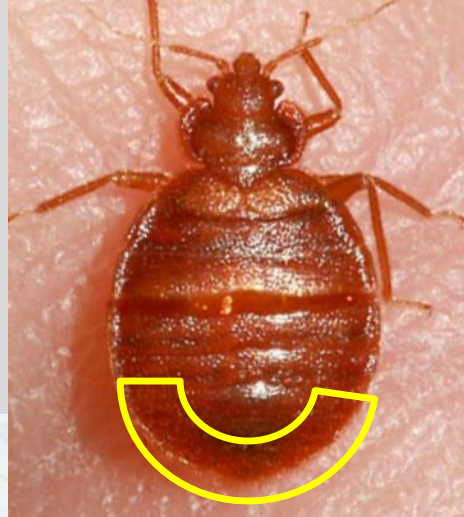
Color

- Smallest nymphs:
 - almost colorless (unfed)
 - crimson (recently fed)
- Larger nymphs and adults:
 - various shades of brown (unfed)
 - reddish brown (fed)

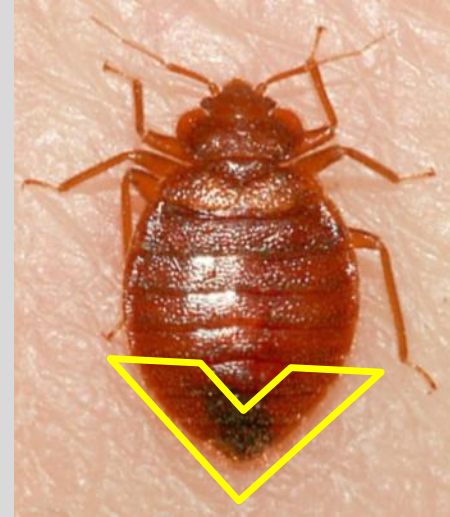


Adult Bed Bugs

Female

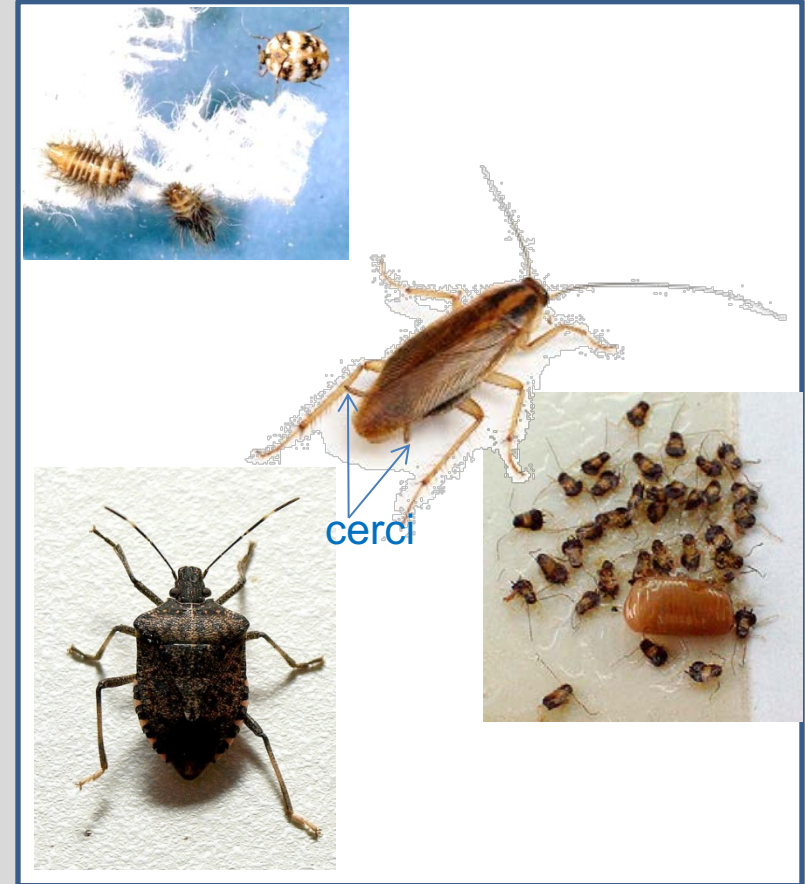


Male



OSU Survey: Common Bed Bug “Imposters”

- Carpet beetles
- Cockroaches (esp. nymphs)
- Stink bugs
- Others, less common
 - Bat bugs
 - Other insects
 - Non-insects

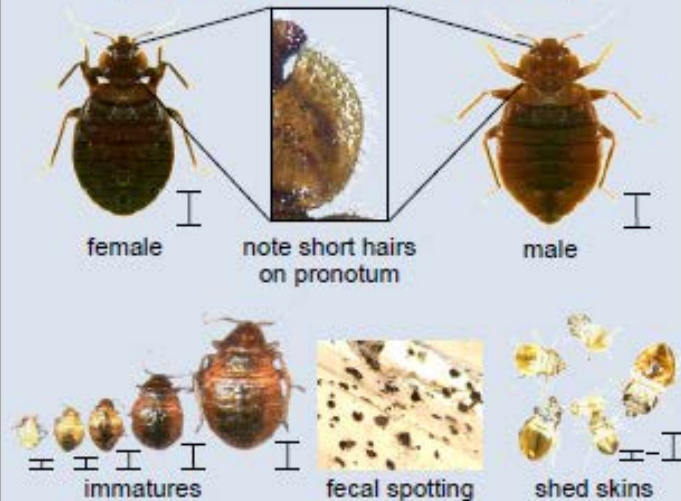


About 15% of customers ask for bed bug treatment when they have a different pest

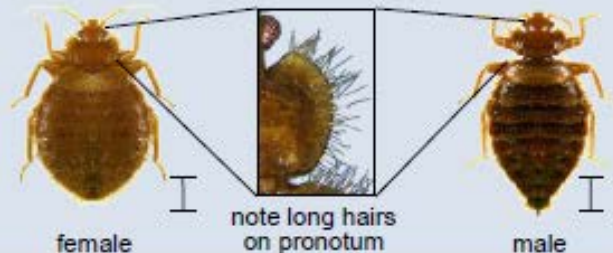
OHIO STATE UNIVERSITY EXTENSION

Household Insect Identification Card

Bed Bug (*Cimex lectularius*)

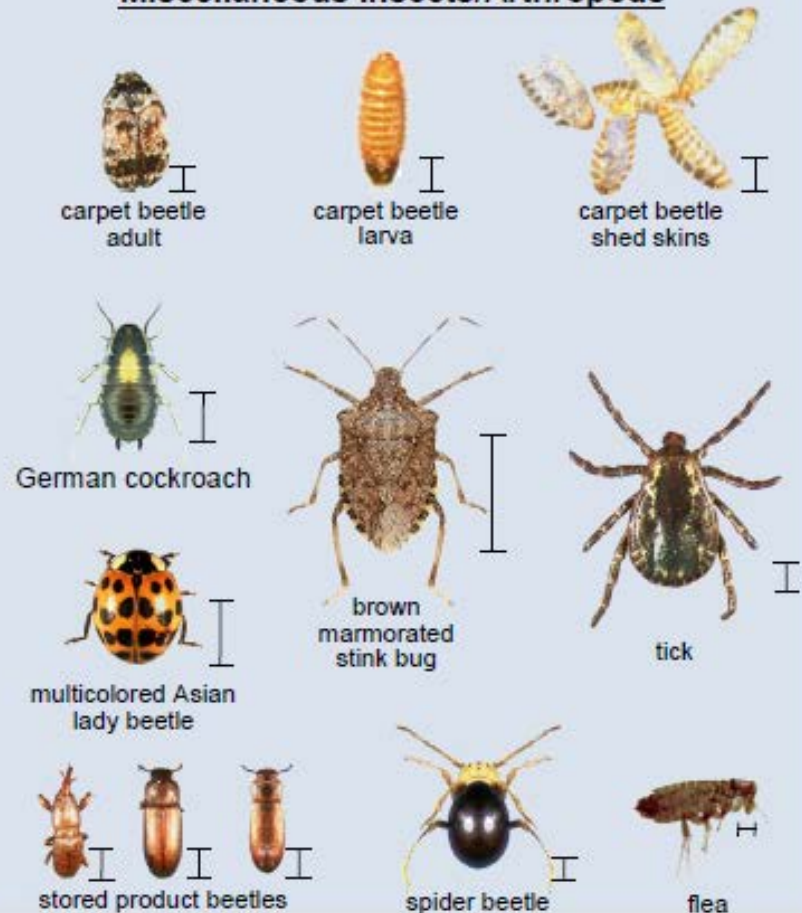


Bat Bug (*Cimex adjunctus*)



Scale bar to lower right of each insect indicates actual size.

Miscellaneous Insects/Arthropods



CFAES-1001-16

S.C. Jones, D.J. DeGirolamo, J.L. Bryant

Supported in part by National Institute of Food and Agriculture, Hatch project 211891, and state and federal funds appropriated to the Ohio Agricultural Research and Development Center, The Ohio State University.

- A pictorial guide for recognizing bed bugs and other household pests
- Information on integrated pest management (IPM) strategies

black carpet beetle
Attagenus unicolor



Know your Pest: Carpet Beetles

**Larval hairs can cause
dermatitis in humans**

- easily mistaken for bed bugs
- multiple symptoms including itching (pruritus) and rash—groups of spots; or red, inflamed skin with or without blisters
- complaints of being bitten by something causing an intense itching and rash
- in some people, irritation of respiratory tract and eyes

furniture carpet beetle
Anthrenus flavipes



varied carpet beetle
Anthrenus verbasci

Carpet Beetles



- Larvae feed on animal materials
 - woolens, carpets, furs, hides, feathers, horns, bones, hair, silk, fish meal, insect pupae, dead insects
 - cause surface damage, misc. holes, uneven areas
- Larvae also feed on plant materials
 - rye meal, corn, red pepper, rice, flour, wheat
- Adults feed primarily on pollen & nectar (esp. *Spiraea* spp. & crape myrtle); pollen is required for egg production



Bridal wreath spirea



Japanese spirea



Crape myrtle

IDENTIFICATION SERVICES

Ohio State University Pest Diagnostic Clinic

- Fee for identification services (\$20 per insect sample)
- ID wide variety of insects, arthropods, plant diseases, etc.
- Online submission form: <http://ppdc.osu.edu>

614-292-5006



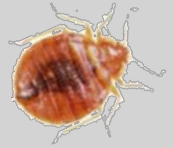
Recognize the telltale signs of bed bugs!



- Black fecal spots
- Shed skins & eggshells
- Live bed bugs (nymphs & adults)
- Blood stains from crushed bugs
- Welts on exposed skin
- Distinctive “buggy” odor (in severe infestations)



Some of the challenges due to bed bugs:



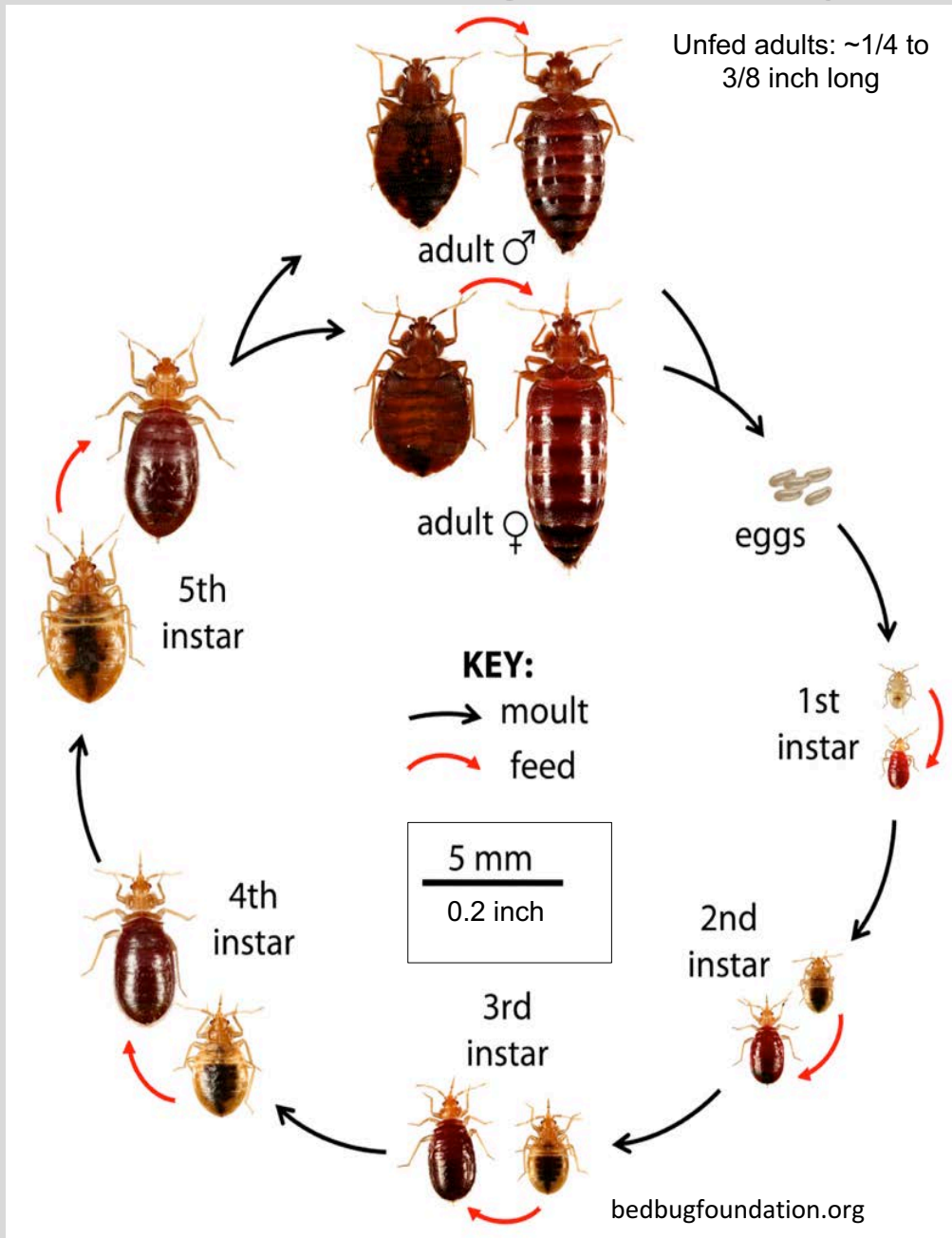
- Nocturnal behavior
- Can feed on multiple warm-blooded animals
- Hide in many sites from floor to ceiling
- Very fast life cycle (many generations / year)
- Strong tendency to disperse
 - Hitchhiking
 - Walking
- Can survive starvation for months and months
- Bites cause variable reactions in humans
- Insecticide resistance
- Etc.



The Bed Bug Life Cycle

**Total developmental
time (egg to adult):**

**21 days @ 86°F
120 days @ 65°F**



Life History Characteristics Show That Bed Bug Numbers Can Quickly Skyrocket ... (Early Detection and Treatment are Very Important)

❖ Eggs



- Glued in place
- 1 – 12 eggs / day / female
- A single female can produce ~150 eggs
- Hatch in 6 – 17 days



❖ Nymphs (immature bugs)

- Five nymphal stages
- Require a blood meal in order to grow

❖ Adults (males & females)

- Require repeated blood meals
- Can live 12 – 18 months
- Can survive months of starvation



BED BUG HABITS



Cannot fly



Can walk very fast



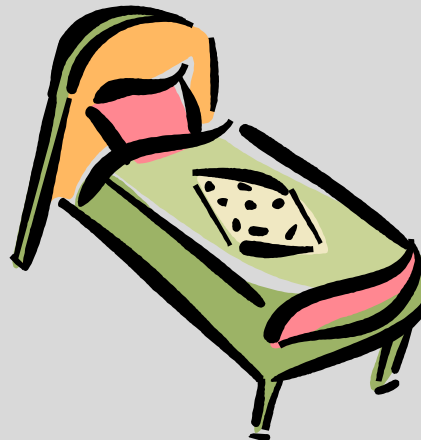
Typically hide during the day in dark, protected sites (esp. cracks & crevices)



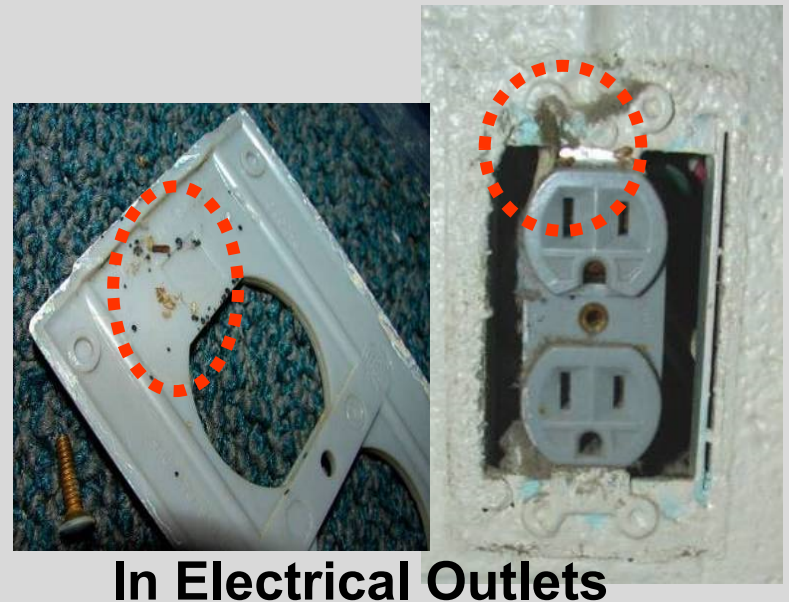
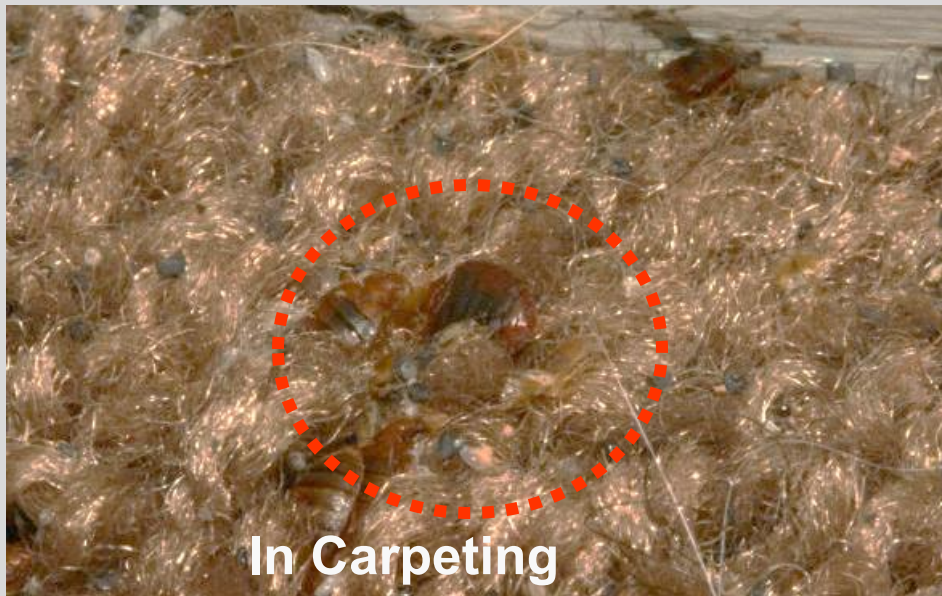
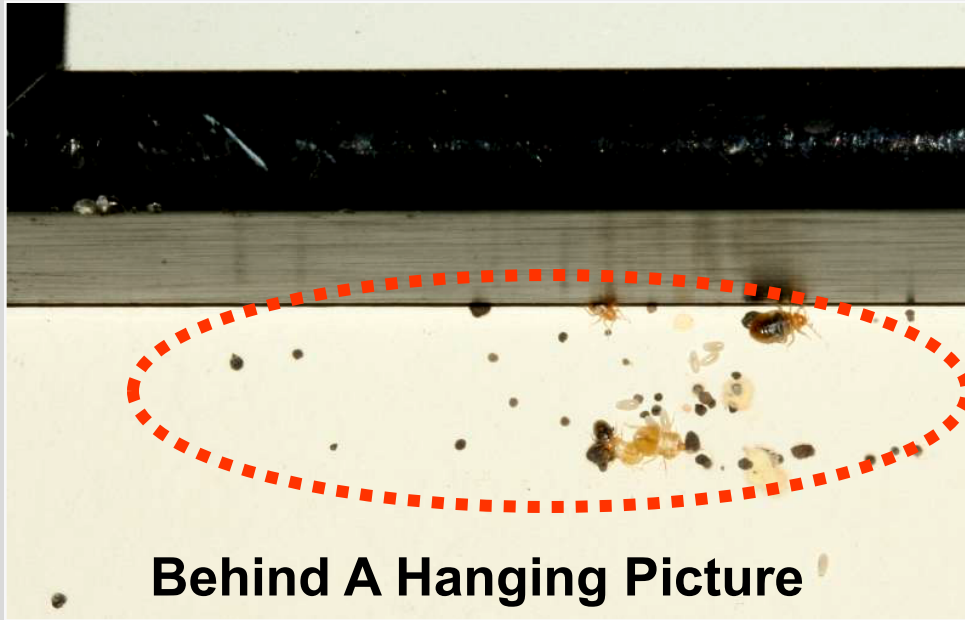
Prefer fabric, wood, and paper surfaces



Can cling tightly to surfaces



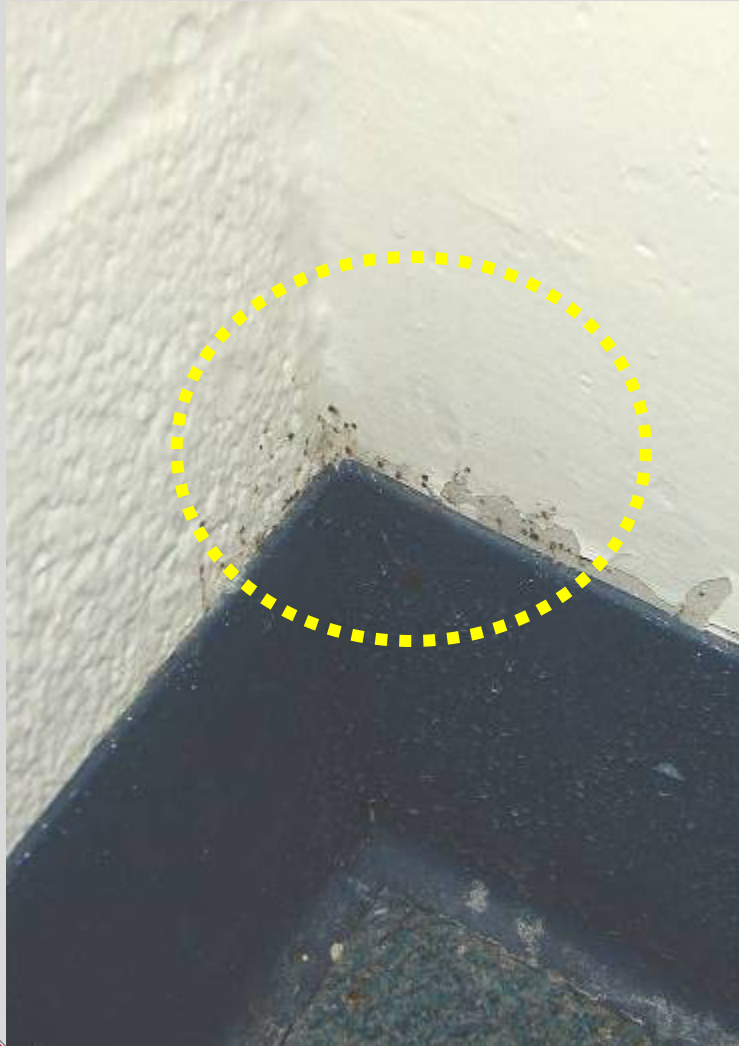
Some bed bug hiding places



Telltale Signs of Bed Bugs in Mattresses and Box Springs



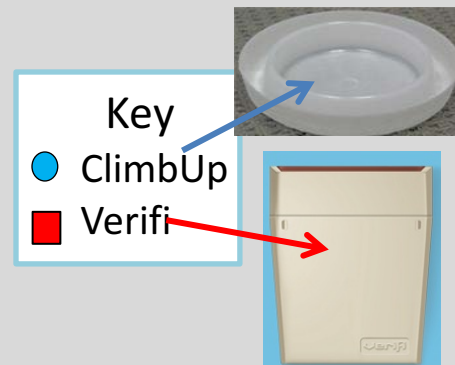
Telltale Signs of Bed Bugs Behind Baseboards



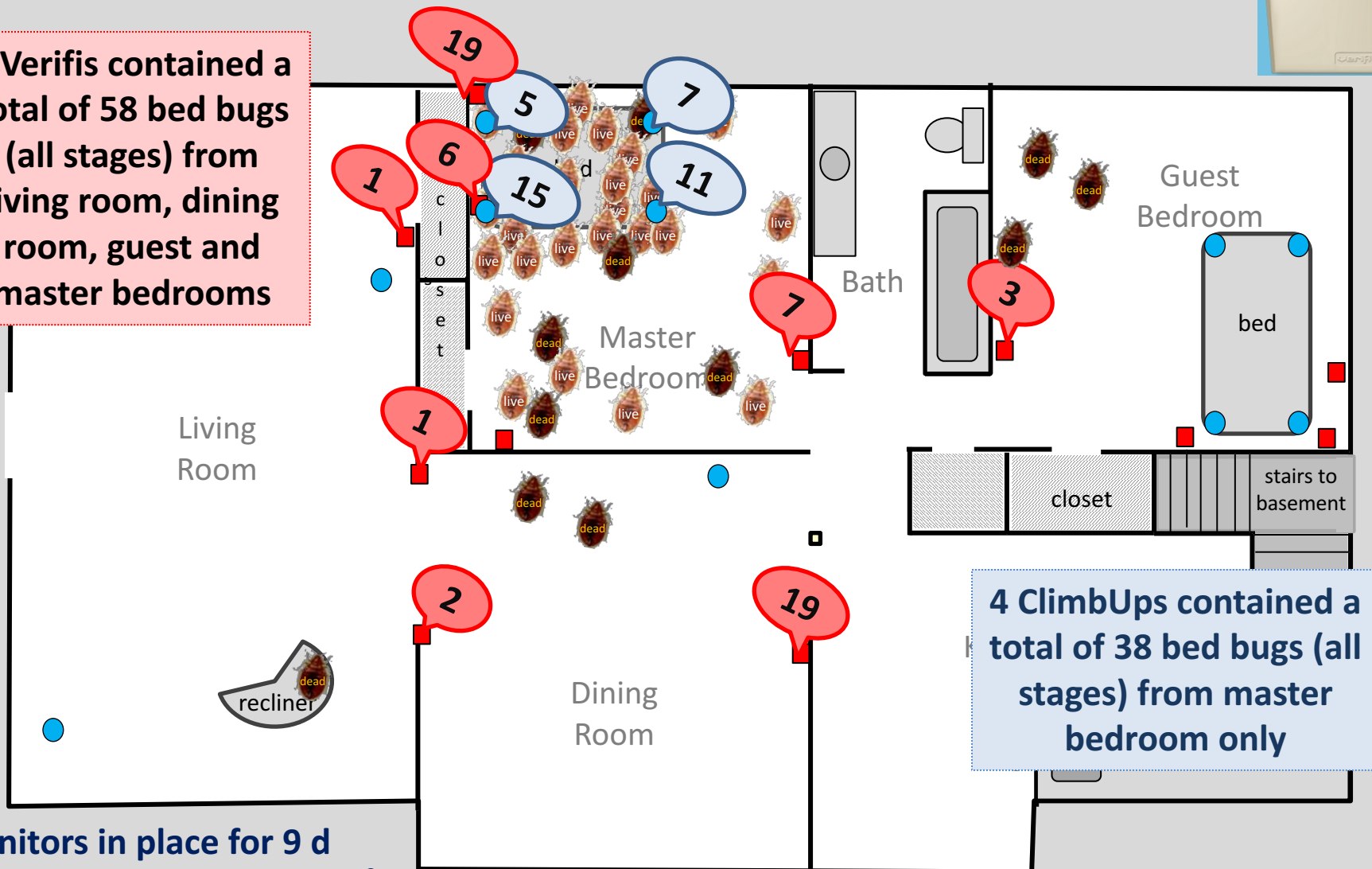
In multi-family housing, bed bugs readily spread to units that are adjacent, below, and above the infested unit.



Bed bug movement in vacant home— Assessment with Monitoring Devices



8 Verifis contained a total of 58 bed bugs (all stages) from living room, dining room, guest and master bedrooms

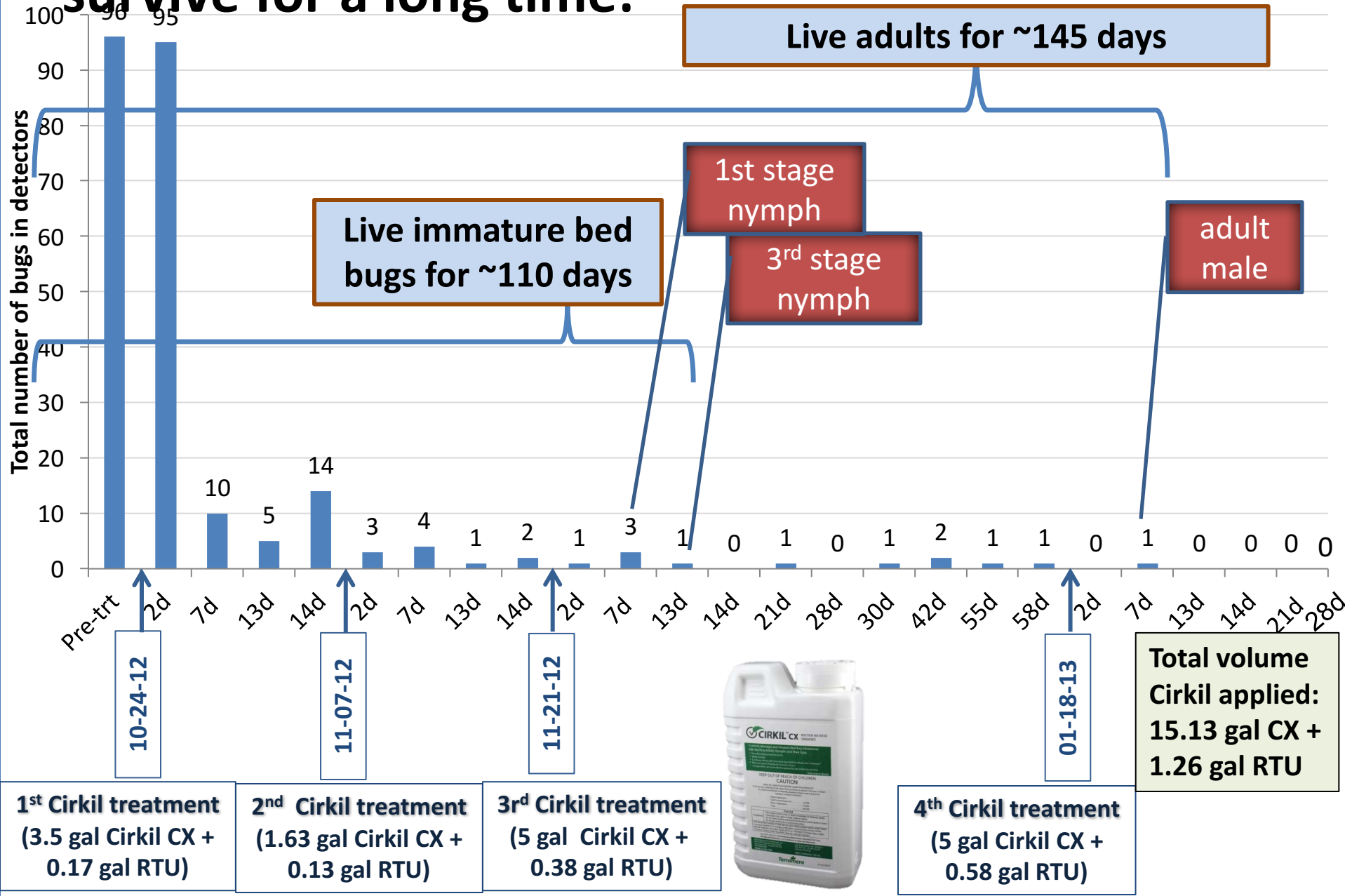


4 ClimbUps contained a total of 38 bed bugs (all stages) from master bedroom only

Monitors in place for 9 d
Home temperature: 65-70°F (18-21°C)

starved bed bugs can survive for a long time:

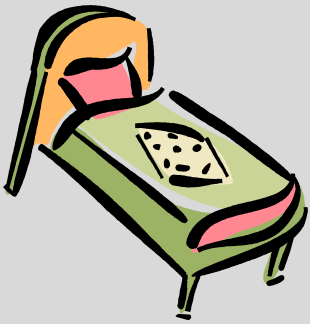
Home vacated: late August 2012
Home temperature: 65-70°F (18-21°C)



Bed bugs are very good hitchhikers!

Bed bugs can be moved from one place to another by hiding in:

- luggage
- furniture
- bedding
- backpacks, purses, briefcases
- clothing
- ...



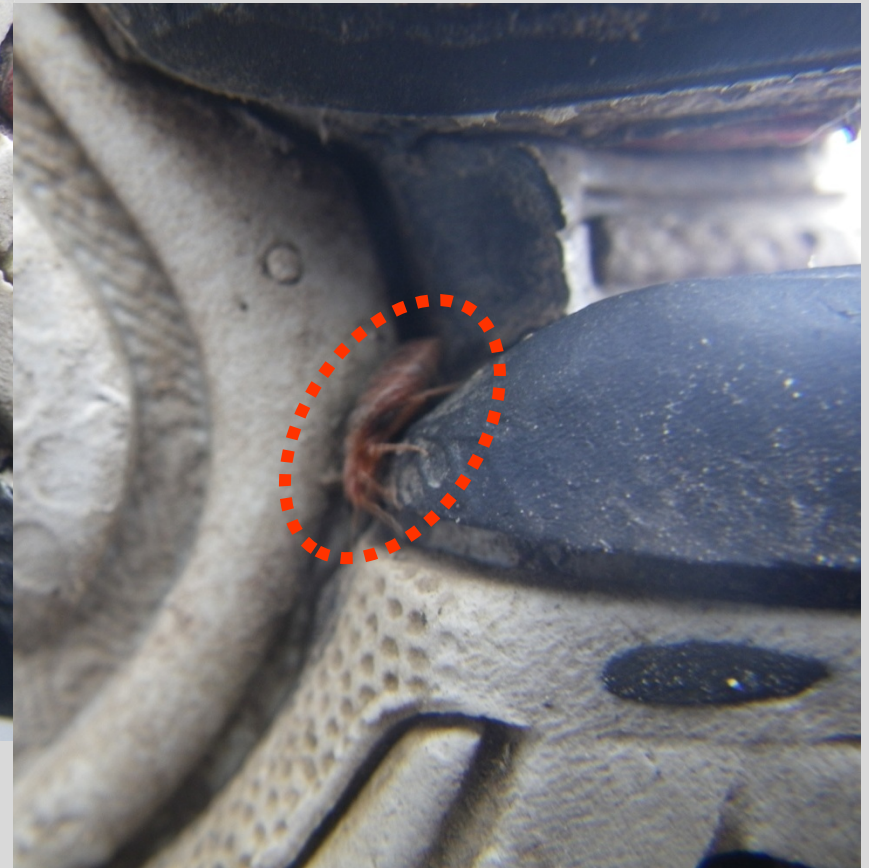
--Bed Bug Hitchhikers— in walker & wheelchair



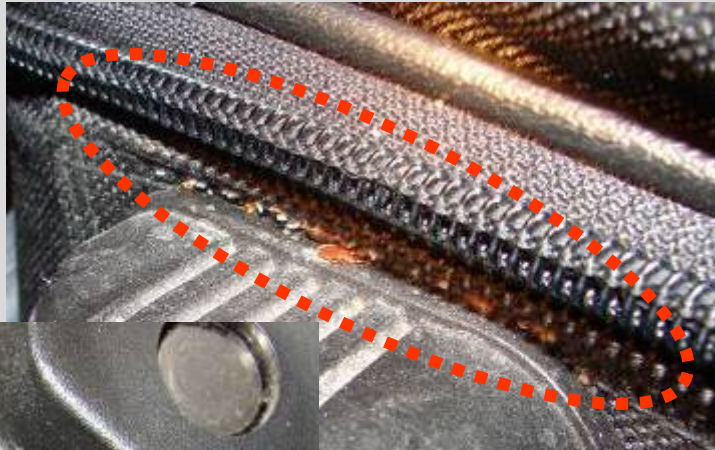
Photos courtesy of General Pest Control Co.



--Bed Bug Hitchhikers— in shoe tread



--Bed Bug Hitchhikers— in luggage



Some Basics of Bed Bug Management

- **Early detection and treatment are very important.**
- **Bed bug control typically is much faster and less expensive when the infestation is detected early.**



Bed Bug Feeding Habits



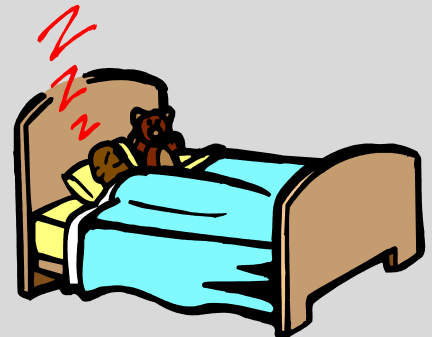
Often closely associated with hosts' sleeping or resting sites (hide in many places)



Locate their host using cues such as carbon dioxide, heat, odor

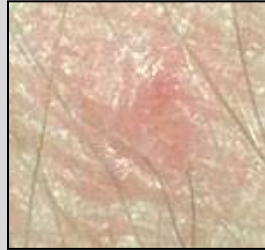


Typically feed at night



Bed Bug Bites

- Skin reactions (avg = 7 of 10 people)
 - Redness
 - Welts
 - Itching
- Resemble bites from other insects & arthropods
- Typically no red spot at the center (such as with fleas and black flies)
- Typically occur on exposed skin
 - Neck and face; shoulders and arms; back; etc.
- Rarely occur on the palms or soles (such as with scabies mites)
- Often occur in rows or groups
- Confirmation based on finding bed bug evidence



Bullous Reactions to Bedbug Bites Reflect Cutaneous Vasculitis

Richard D. deShazo, MD,^a Mark F. Feldlaufer, PhD,^b Martin C. Mihm, Jr, MD,^c Jerome Goddard, PhD^d

^aDivision of Clinical Immunology and Allergy, Departments of Medicine and Pediatrics, The University of Mississippi Medical Center, Jackson; ^bInvasive Insect Biocontrol and Behavior Laboratory, US Department of Agriculture, Beltsville, MD; ^cDepartment of Pathology, Harvard Medical School, Boston, Mass; ^dDepartment of Biochemistry, Molecular Biology, Entomology and Plant Pathology, Mississippi State University, Mississippi State.



Figure 1 Bullous reaction from an accidental bite of a *C. lectularius* nymph 24 hours after the bite. There is a visible path where the nymph appears to have probed before feeding at the main site (arrow). Line equals 10 mm.



Figure 3 Sequential photographs of a bedbug feeding site in our study subject between 24 hours and 4 weeks. There was progression from blister to bulla, lysis of bulla, and gradual healing at the bulla base with scarring and hyperpigmentation.

August 2010



Joint Statement on Bed Bug Control in the United States from the U.S. Centers for Disease Control and Prevention (CDC) and the U.S. Environmental Protection Agency (EPA)

Introduction and Purpose

The Centers for Disease Control and Prevention (CDC) and the U.S. Environmental Protection Agency (EPA) developed this document to highlight emerging public health issues associated with bed bugs (*Cimex lectularius*) in communities throughout the United States.

Bed bugs (Photo 1) have been common in U.S. history. Although bed bug populations dropped dramatically during the mid-20th century (1), the United States is one of many countries now experiencing an alarming resurgence in the population of bed bugs. Though the exact cause is not known, experts suspect the resurgence is associated with increased resistance of bed bugs to available pesticides, greater international and domestic travel, lack of knowledge regarding control of bed bugs due to their

prolonged absence, and the continuing decline or elimination of effective vector/pest control programs at state and local public health agencies.

In recent years, public health agencies across the country have been overwhelmed by complaints about bed bugs. An integrated approach to bed bug control involving federal, state, tribal and local public health professionals, together with pest management professionals, housing authorities and private citizens, will promote development and understanding of the best methods for managing and controlling bed bugs and preventing future infestations. Research, training and public education are critical to an effective strategy for reducing public health issues associated with the resurgence of bed bug populations.

Impact of Bed Bugs on Public Health

Although bed bugs are not known to transmit disease, they are a pest of significant public health importance. Bed bugs fit into a category of blood-sucking ectoparasites (external parasites) similar to head lice (*Pediculus humanus capitis*). Bed bugs, like head lice, feed on the blood of humans but are not believed to transmit disease. Other ectoparasites, such as body lice (*Pediculus humanus corporis*), are known to transmit several serious diseases. Differences in the biology of similar species of pests, such as body lice and head lice (or bed bugs) can greatly impact the ability of pests to transmit disease.



Photo 1. Bed Bug. Photo courtesy of Dr. Harold Harlan, Armed Forces Pest Management Board Image Library

CDC & EPA Joint Statement

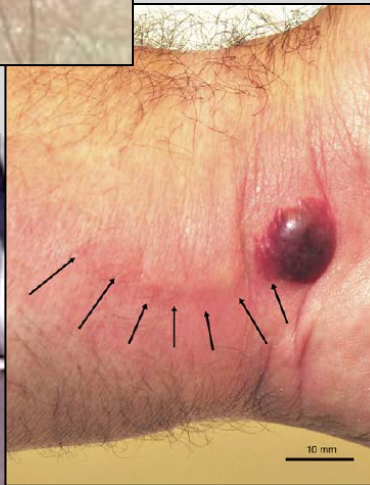
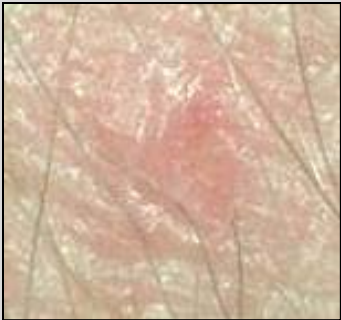
Bed bugs are a
pest of significant
public health
importance!

http://www.cdc.gov/nceh/ehs/Publications/Bed_Bugs_CDC-EPA_Statement.htm

<http://www.epa.gov/pesticides/bedbugs/>

Health Effects from Bed Bugs

- Skin reactions (7 of 10 people on avg.)
 - Redness
 - Welts
 - Itching
- Secondary bacterial infections
- Anemia
- Asthma
- Anaphylactic shock
- Psychological effects
- Sleeplessness
- Agitation
- Anxiety
- Insecticide exposure
- ...



Bed bugs and possible transmission of human pathogens: a systematic review

Olivia Lai¹ · Derek Ho² · Sharon Glick³ · Jared Jagdeo^{2,3,4}

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Abstract The global population of bed bugs (*Cimex lectularius* and *Cimex hemipterus*, family Cimicidae) has undergone a significant resurgence since the late 1990s. This is likely due to an increase in global travel and the number of insecticide-resistant bed bugs. The bed bug population is estimated to be increasing by 100–500 % annually. The worldwide spread of bed bugs is concerning, because they are a significant social burden and a major concern to public health. At the United States Environmental Protection Agency, bed bugs are “a pest of significant health importance”; 68 % of U.S. pest professionals report that bed bugs are the most challenging pest to treat. Upward of 100 human diseases have been reported in bed bug studies report that bed bugs may be competent vectors of pathogens, such as *Bartonella quintana* and *Trypanosoma cruzi*. However, public health reports have thus far produced evidence that major infectious diseases have been associated with bed bugs. Since many pathogens have previously been reported in bed bugs, the worldwide bed bug population is now dramatically increasing, it stands to reason to wonder if bed bugs transmit human pathogens. This review includes a literature search on recently published clinical and laboratory studies (1990–2016).

- So far, no studies have shown evidence that bed bugs are able to spread human diseases.
- Some studies have shown cimicids (bed bug relatives) can transmit disease to birds or bats.
- Certain human diseases can survive in bed bugs in the laboratory – a worrying sign.
- Even without spreading disease, bed bugs can cause health problems.

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³ Department of Dermatology, State University of New York Downstate Medical Center, Brooklyn, NY, USA

⁴ Department of Dermatology, University of California Davis, Sacramento, CA, USA

...to reach 1.8 billion [30]. Travelers are at a particular risk for infestation, as bed bugs have been detected in aircraft, boats, trains, and hotels [12]. The global bed bug population is estimated to be increasing by 100–500 % annually [3]. In one nationwide survey, 99.6 % of United States (U.S.) pest professionals reported that they have treated bed bugs in the past year, and 68 % of U.S. pest professionals reported that bed bugs are the most challenging pest to treat [30].

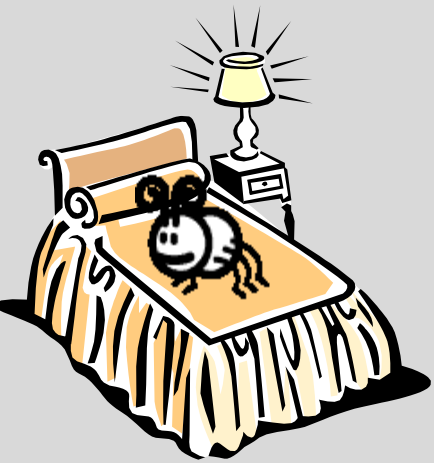


Bed Bug Prevention

- Recognize the telltale signs of bed bugs
- Take measures to reduce the risk of getting bed bugs
- Prevent bugs from spreading to new sites



**Did you check for signs
of bed bugs in your
hotel/motel room when
you last traveled?**



BED BUG PREVENTION FOR TRAVELERS

Make it STANDARD PRACTICE to check for bed bugs in hotel/motel rooms!

- Pull back the bedding and look for black fecal spots on mattress & box springs (especially seams)
- Carefully examine the underside of the bed skirt
- Look for bb signs along bed frame (especially head board)
- Open nightstand drawers and look for bb signs along inner and outer edges
- Look for bb signs along baseboards



DON'T STAY IN A ROOM THAT HAS BB SIGNS

BED BUG PREVENTION FOR TRAVELERS

**Reduce the chances of getting bed bugs
from hotel/motel rooms!**

- Keep clothes in your zipped suitcase
 - Don't keep clothes in hotel chest-of-drawers
 - OK to hang clothes in closet
- Don't store your suitcase on the bed, floor, or upholstered furniture
- Keep your suitcase on the luggage rack (after first inspecting it for bb signs)
- The bathroom (tub) is the best place to store your items!



BED BUG PREVENTION AT HOME

Don't bring infested items home!

- **Inspect clothing and luggage of travelers**
- **Inspect secondhand beds, bedding, furniture, & clothing**



INTEGRATED PEST MANAGEMENT (IPM) :

Correctly identify the pest

+

Conduct a thorough inspection

+

Use sanitation measures

+

Use non-chemical measures

+

Apply insecticides to targeted sites

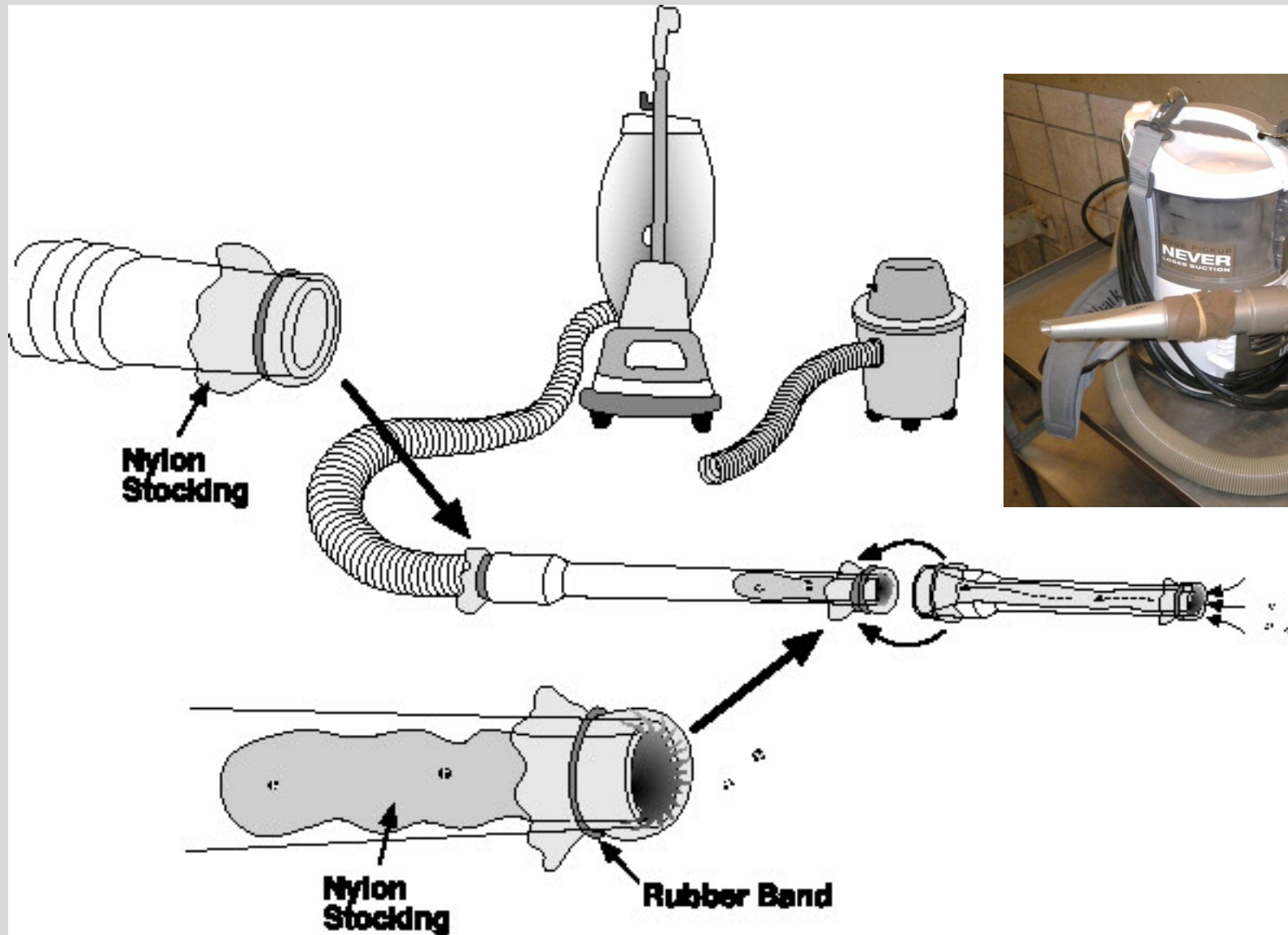
Some measures to help reduce the number of bed bugs:

Use a heavy-duty vacuum cleaner.



- Use a high efficiency particulate air (HEPA) filtered vacuum cleaner.
- It is useful to reduce the number of bed bugs. (A scraping action with the attachment is needed to remove eggs.)
- It is useful for cracks & crevices.
- Dispose of the vacuum bag afterwards.
- Remember that an on-site vacuum can serve as a harborage for bed bugs.

Vacuuming to contain bed bugs



Some measures to help reduce the number of bed bugs:

Steaming

- Commercial steam unit preferable
- Dry steam preferable (less moisture)
- Surface temperature should be ~176°F (80°C)
- Steam immediately kills bed bugs & eggs
- Requires working slowly and thoroughly
- Steam can penetrate many fabrics & padding
 - Some materials too thick for heat transfer
- Prolonged drying time (use fan, dehumidifier, natural ventilation)
- No residual protection



Disinfect Items by ★★★ Laundering & Drying ★★★ (kills all bed bug life stages)

Launder clothing

- Wash in hot water ($\geq 120^{\circ}\text{F}$)
- Use drier on hot setting (≥ 30 mins.)
- Dry clean items



Cold treatment has limitations for bed bugs


- Bed bugs are hardier against cold than heat
- They can be killed by freezing **continuously** at $<19^{\circ}\text{F}$ (-7°C) for 3 weeks or $<5^{\circ}\text{F}$ (-15°C) for 4 days
 - **Small** items can be placed in freezer at these temperatures to kill bed bugs (larger items are more insulated against cold)
 - Chest freezers work well; refrigerator-freezer units can work *if "frost-free" setting is disabled*. Use thermometer and timer to ensure proper treatment
- "Cold treatments" commercially available involve spraying items with dry ice—not yet much research into this kind of treatment
 - NOT a standalone measure (need to supplement with additional types of treatment)
 - Won't penetrate certain materials, such as paper




Reasons why residents should not dispose of furniture, mattresses, etc.:



- Infested furniture often can be treated to eliminate the bed bugs.
- Bed bugs can quickly infest replacement furniture.
- Bed bugs will fall off the furniture as it is being moved, hence spreading the problem.
- Items placed in dumpsters often are picked up and reused, thereby spreading bed bugs to other households.
- If you choose disposal--Treat, deface, and wrap items before disposing of them



DON'T use ultrasonic
repellent devices against
bed bugs or other insects.



Efficacy of Commercially Available Ultrasonic Pest Repellent Devices to Affect Behavior of Bed Bugs (Hemiptera: Cimicidae)

K. M. YTURRALDE¹ AND R. W. HOFSTETTER

School of Forestry, Northern Arizona University, 200 East
AZ 86011

J. Econ. Entomol. 99:166-171, 2006
ABSTRACT Little is known about the behavior of bed bugs, *Cimex lectularius* L. (Hemiptera: Cimicidae), although many studies have been conducted on bed bug biology. The influence of sound on bed bug behavior and control of bed bugs by commercially available ultrasonic repellent devices was tested. Bed bugs were exposed to sound with or without sound pulses during choice trials. Host choice trials showed that bed bugs did not choose the ultrasonic repellent device with or without sound pulses over the control (no sound) during choice trials. However, bed bugs were more likely to exit the middle compartment of the choice trial when exposed to sound. Our results confirm that sound is not a promising tool for repelling bed bugs.

KEY WORDS bed bug



bed bugs nearby

cockroach feces

cockroach shed skin

Cimex lectularius



DON'T use bug bombs
for bed bugs!



Bug bombs can worsen a bed bug problem!



- "Bug Bombs" work very poorly against crawling insects
- Few bugs will be killed!
- "Bug Bombs" can cause bed bugs (and cockroaches) to scatter!!!



Over-the-Counter Foggers (“Bug Bombs”)

“Kills on contact”
“Effective long-term control”



“Kills on contact”
“Kills flying, crawling, and biting insects”



“Kills on contact”
“Kills bugs you see, kills bugs you don't see!”



HOUSEHOLD AND STRUCTURAL INSECTS

Ineffectiveness of Over-the-Counter Total-Release Foggers Against the Bed Bug (*Heteroptera: Cimicidae*)

SUSAN C. JONES¹ AND JOSHUA L. BRYANT

Department of Entomology, The Ohio State University, 2501 Carmack Road, Columbus, OH 43210-1065

J. Econ. Entomol. 105(3): 957–963 (2012); DOI: <http://dx.doi.org/10.1603/EC12037>

ABSTRACT Field-collected bed bugs (*Cimex lectularius* L.) showed little, if any, adverse effects after 2-h direct exposure to the aerosolized pyrethroid(s) from three over-the-counter total-release foggers ('bug bombs' or 'foggers'); Hotshot Bedbug and Flea Fogger, Spectracide Bug Stop Indoor Fogger, and Eliminator Indoor Fogger. One field-collected population, EPM, was an exception in that there was significant mortality at 5–7 d when bugs out in the open had been exposed to the Spectracide Fogger; mortality was low when these bugs had access to an optional harborage, a situation observed for all field-collected populations when exposed to the three foggers. Even the Harlan strain, the long-term laboratory population that is susceptible to pyrethroids and that served as an internal control in these experiments, was unaffected if the bugs were covered by a thin cloth layer that provided harborage. In residences and other settings, the majority of bed bugs hide in protected sites where they will not be directly contacted by the insecticide mist from foggers. This study provides scientific data supporting the position that total-release foggers should not be recommended for control of bed bugs, because 1) many field-collected bed bugs are resistant to pyrethroids; they are not affected by brief exposure to low concentrations of pyrethrins and/or pyrethroids added by foggers; and 2) there is minimal, if any, insecticide penetration into typical bed bug harborage. This study provides strong evidence that Hotshot Bedbug and Flea Fogger, Spectracide Bug Stop Indoor Fogger, and Eliminator Indoor Fogger were ineffective as bed bug control.





DON'T believe everything
that you read on the
internet about bed bugs.



Some questions to ask clients who suspect that they have bed bugs:

- Do you live in a single family home or apartment building?
- Have you captured / photographed any of the suspected bbs?
 - Yes: Have they been positively identified? Who did the ID? What stage(s) were present?
 - No: Have you seen any? Describe the bug.
- Why do you think that you have bed bugs (bbs)?
 - What are the symptoms?
 - When and where in residence?
 - Had you traveled or had visitors (esp. overnight) near the time when symptoms first appeared? (Any mention of bbs?) Have you recently acquired new or used furniture?
- Have you attempted to treat for bbs?
 - Yes: What measures have you taken? What results?

Some useful resources on bed bugs





Search ...



Home

About Bed Bugs

Prevention

Treatment

Guidance for Professionals

Summit Presentations

About COBBTF

Contact Us

<http://centralohiobedbugs.org>

Features:

- Advice for specific groups (hospitality, social work, schools, etc.)
- COBBTF conference presentations
- Links to resources specific to Central Ohio

> Moving Tips

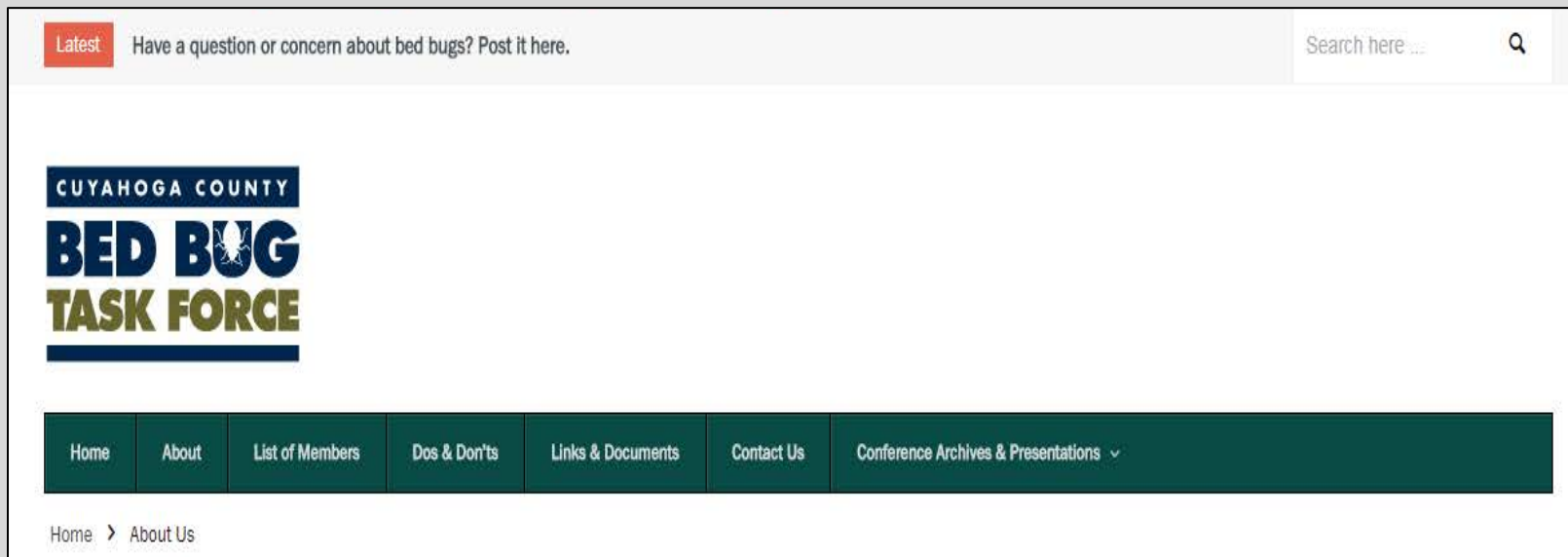
Columbus

Columbus Code Enforcement
Request a confirmation number.

Worthington

City Office (614) 431 - 2424

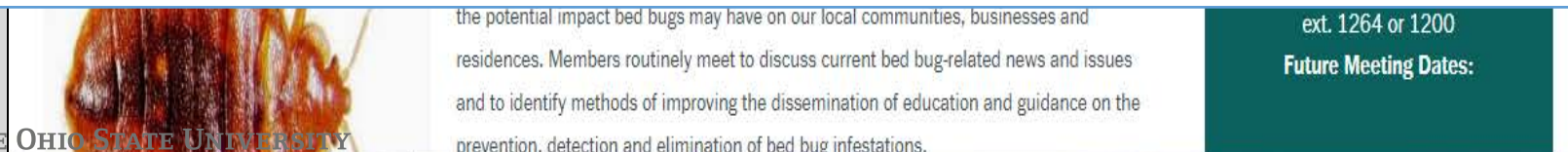




<http://www.cuyahogabedbugs.org/the-cuyahoga-county-bed-bug-task-force>

Features:

- CCBBTF conference presentations
- Links to resources specific to Cleveland area





Let's Beat the Bed Bug!

Home

Bed Bug Control in Residences ▾

Home Visitors ▾

Homeowners and Tenants ▾

Pest Management Professionals ▾

Property Owners and Managers

Public Facilities ▾

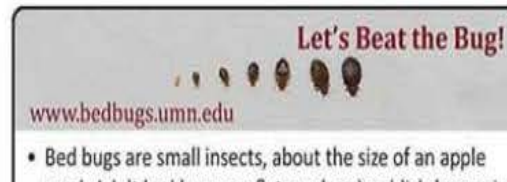
Resources ▾

Travelers ▾

Have I Found a Bed Bug?

Bed Bug Identification Card

The Bed Bug Identification Card is a simple visual tool to help in identifying bed bugs. Showing the actual size of bed bugs and a couple of hiding places this small card can be carried in your wallet for when you most

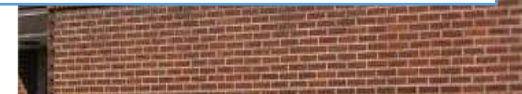


<https://www.bedbugs.umn.edu>

Features:

- Fact sheets and resources in numerous languages
- Video tutorials

Resources



IPM Guide
for Affordable Housing
Free Download



News You Can Use

December 21, 2017 **StopPests Webinar with Bobby Corrigan - Tools For Eliminating Mice - Recording is Online** Eliminating mice in multifamily housing can be a daunting task, like "bailing out the ocean with a teaspoon" but it doesn't have to be if you have the right tools and

<http://www.stoppests.org>

Features:

- Comprehensive IPM overview (covers various pests, not only bed bugs)
- Videos and written guides

ABOUT US
Staff and Partners
Participating Providers
Conference Presentations

WHAT
Definit
Using
Fundin



The Northeastern IPM Center receives
facilitate this program. The materials co
their entirety. Any nonobjective or partial
illustrative purposes only and are not m



New York State Integrated Pest Management

About

Agriculture

Community

Environment

Resources

What's Bugging You?

NEWA

EIQ

What's Bugging You

Ants

Bats

Bed Bugs

Bed Bug FAQs

Birds

Cockroaches

Deer

Fabric Pests

Fleas

Flies Indoors

<https://nysipm.cornell.edu/whats-bugging-you/bed-bugs>

Features:

- Numerous downloadable fact sheets, pamphlets, handouts, etc. with illustrations
- Spanish-language fact sheets and resources



MY ACCOUNT

Buy Bed Bug Products News

TRAINING ▾ PEST PROFESSIONALS ▾ BED BUGS 101 ▾ BED BUG TV ▾ ACTIV & VOLCANO ABOUT US ▾



Bed Bug T

Bed Bug TV, hosted by Jeff White, is an on

BEDBUG TV: Home All Episodes

Bed Bug Detection



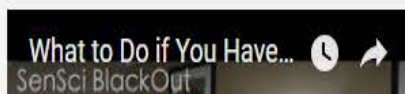
Peace of Mind Bed Bug Services



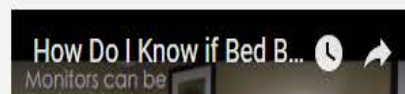
How to Use SenSci Activ in BlackOut



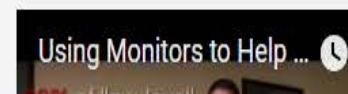
How to Inspect a Bed for Bed Bugs



What to Do if You Have...
SenSci BlackOut



How Do I Know if Bed B...
Monitors can be



Using Monitors to Help ...
of low level

<https://www.bedbugcentral.com>

Features:

- Many video tutorials

NOTE: OSU does not endorse specific products or services.

Coming Soon...

OSU's Bed Bug Field Guide

- Free mobile app
- Bed bug identification, biology, and IPM strategies at your fingertips



Collaboration between:

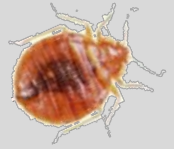
- EduTechnologic
- OSU Urban Entomology team

Funding provided by:

- EPA Region 5
- Ohio Dept. Agriculture (ODA)



Bed Bugs: Know Your Enemy



You now should be familiar with:

- *The growing bed bug problem*
- *How to recognize bed bugs and their tell-tale signs*
- *Biological characteristics of bed bugs*
- *Some health effects due to bed bugs*
- *How to protect oneself from bed bugs*
- *Some questions to ask clients who suspect that they have bed bugs*
- *Useful resources on bed bugs*



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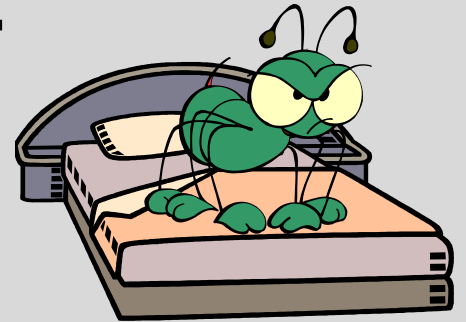


THE OHIO STATE UNIVERSITY

Thank You!

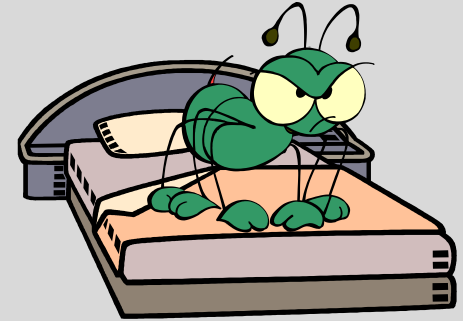


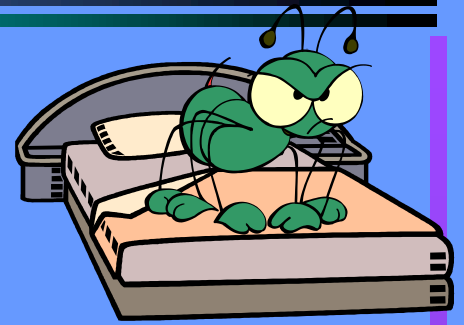
Sleep tight,
and don't let the ...
... well, you know the rest





Questions?





Help us improve...tell us what
you thought of the webinar.

<https://www.surveymonkey.com/r/bbwweb1>