

# So do we have a Bed Bug crisis and what are we doing about it NOW?

Dr. Paul Baker  
Professor and Urban Extension Entomologist  
University of Arizona  
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2012 Vector Control Conference

# Overview

- \* Lets Review
- \* Bed bugs the HUMAN ISSUES
  - \* Client awareness
  - \* Human hysteria

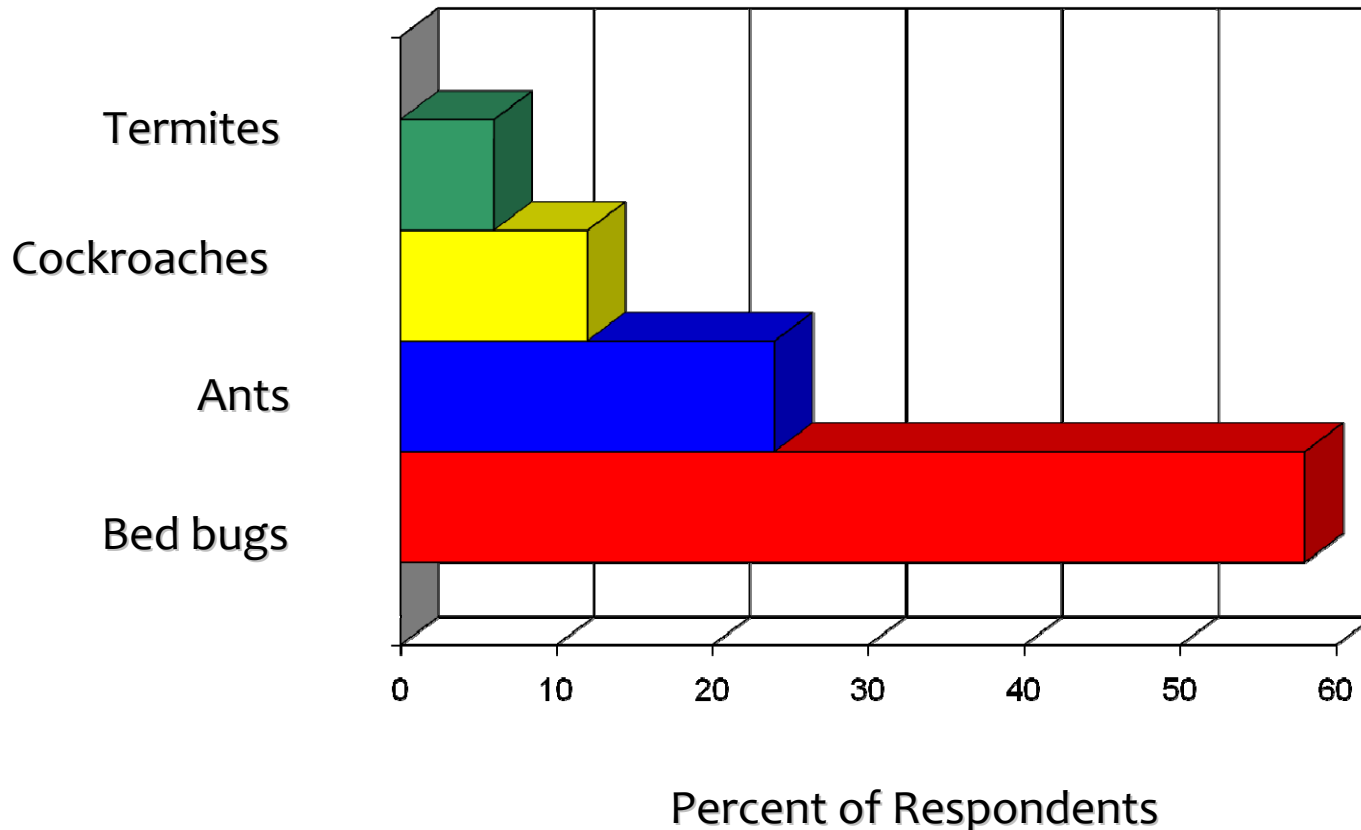
# Let's Review

Bed Bugs: Biology,  
Ecology and  
Control



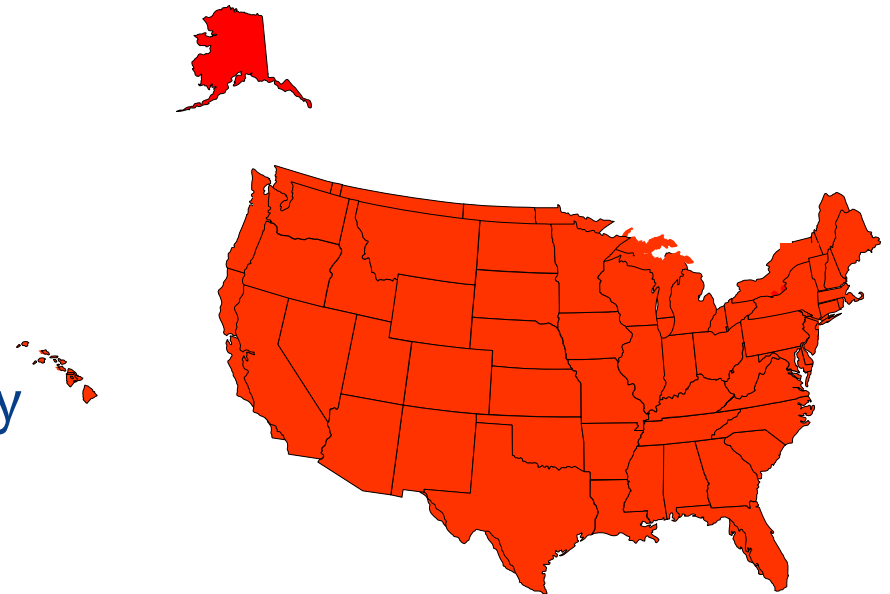
# Hardest To Control Pests PMP Survey Results 2008 (and Now?)

Survey of Pest Management Professionals (PMP's) considering which pests are hardest to control.



# Bed Bug Occurrence Survey

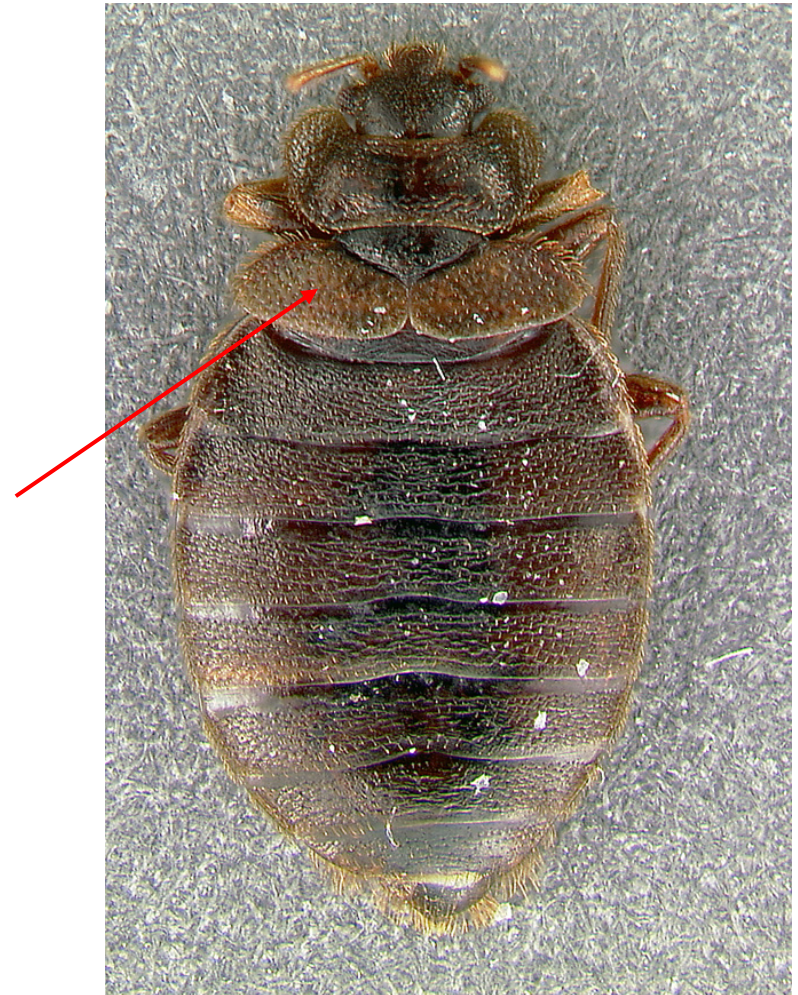
- \* Bedbugs on the rise... Survey Results\*
  - 500 US PMPs surveyed for bedbug encounters
    - > 5 years ago only 37%
    - Last two years... 91%
  - Infestations occur east to west. (NPMA)
  - All 50 states
  - Bed bugs are NOT effected by Climate change



# Bed Bugs (*Cimex lectularius* (L.))

## General Description: Adult

- \* Small – 3/16 inch long, flattened and broadly oval if unfed... cigar shaped after feeding
- \* Reddish to mahogany brown in color
- \* Vestigial wings (reduced to stubs – cannot fly) & a thin layer of fine golden hairs

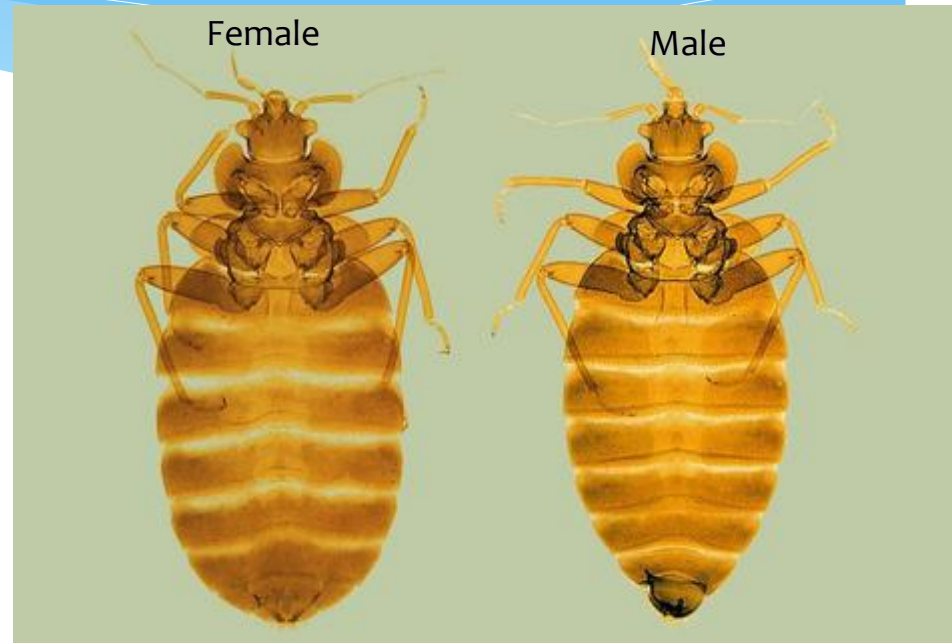




# Bed Bug Adults ♀ ♂: ID by Shape



Dorsal (back) view. Above. Male ♂ (Left) and Female ♀ (Right) Photo credit. Jack Scott. Univ. Alberta.



Ventral (stomach) view. Above. Female ♀ (Left) and male ♂ (Right) Photo credit. Univ. Toronto.

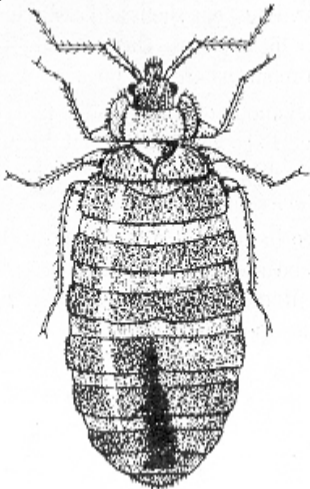
- \* Females ♀ have a much more rounded abdomen shape than their male counterparts.

# Bed Bug Adults: Appearance After Blood Meal



**Above.** Mature bed bug before feeding.

**Below:** Mature bed bug after feeding.



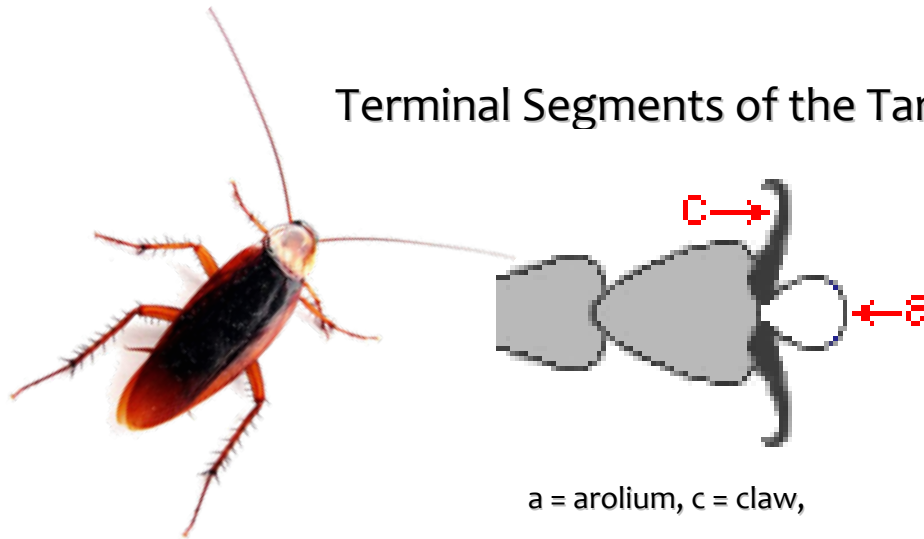
Mature female bed bug after feeding.

Note distended abdomen and altered “cigar” body shape.



# Cockroach: Tarsi with Suction Pads Can Climb Smooth Surfaces

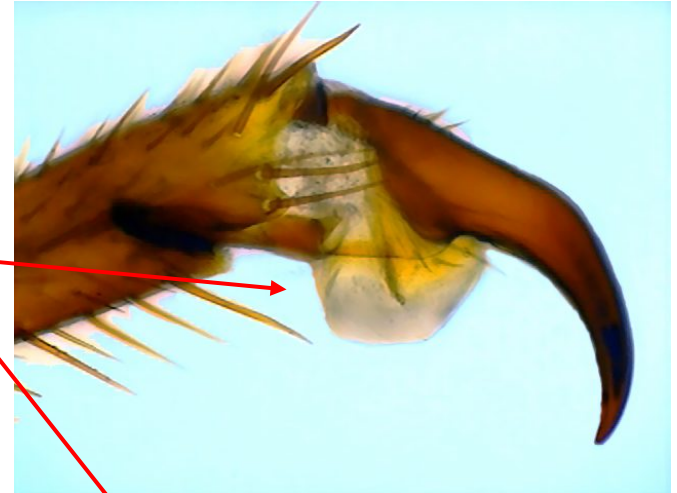
Terminal Segments of the Tarsus



a = arolium, c = claw,

Kendall Bioresearch Services. Bristol, UK.

The last tarsal segment may be extended between the claws to form a pad-like organ - the **arolium**. These structures - arolium, *produce a sticky secretion and act like 'suction-pads', enabling the insect to climb smooth or steep surfaces.* This is the secret of the cockroaches' ability to walk up-side-down on the ceiling or on smooth surfaces.



Walter Dioni. Cancun, Quintana Roo. Mexico.

## Bed Bugs: Tarsi Devoid of Suction Pads *Hard to Climb Smooth Surfaces*



Photo: T Nishimura. BASF

Bed bug legs are adapted for crawling. The claws are used for gripping rough surfaces or for gripping host to insert mouthparts. **Bed bug tarsi do not have “suction” pads and cannot climb smooth surfaces.**

# Bed Bug Life Cycle: Eggs



- \* Bed bug eggs are whitish and small (1/32" long)
- \* Note "lid" at one end where the young will emerge.
- \* Often found in crevices and in clusters of 10-50 eggs.
- \* Egg is "sticky" when laid and will adhere to surfaces.



- \* Nymph forcing its way out of egg capsule
- \* After hatching; the egg case will frequently remain in place.

# Bed Bugs: Life Cycle Timeline – Eggs and Hatch

- \* Adult females will feed, mate and start laying eggs 3-6 days later.
- \* She may lay 3 eggs/day but more often 5-7 eggs/week.
- \* After laying, eggs hatch in 7-10 days at room temperature
- \* Adult females can lay eggs until death (3++ months)
  - \* During lifetime she can lay 200-500 viable eggs

Mating



Eggs Laid



Eggs Hatch



3-6 days

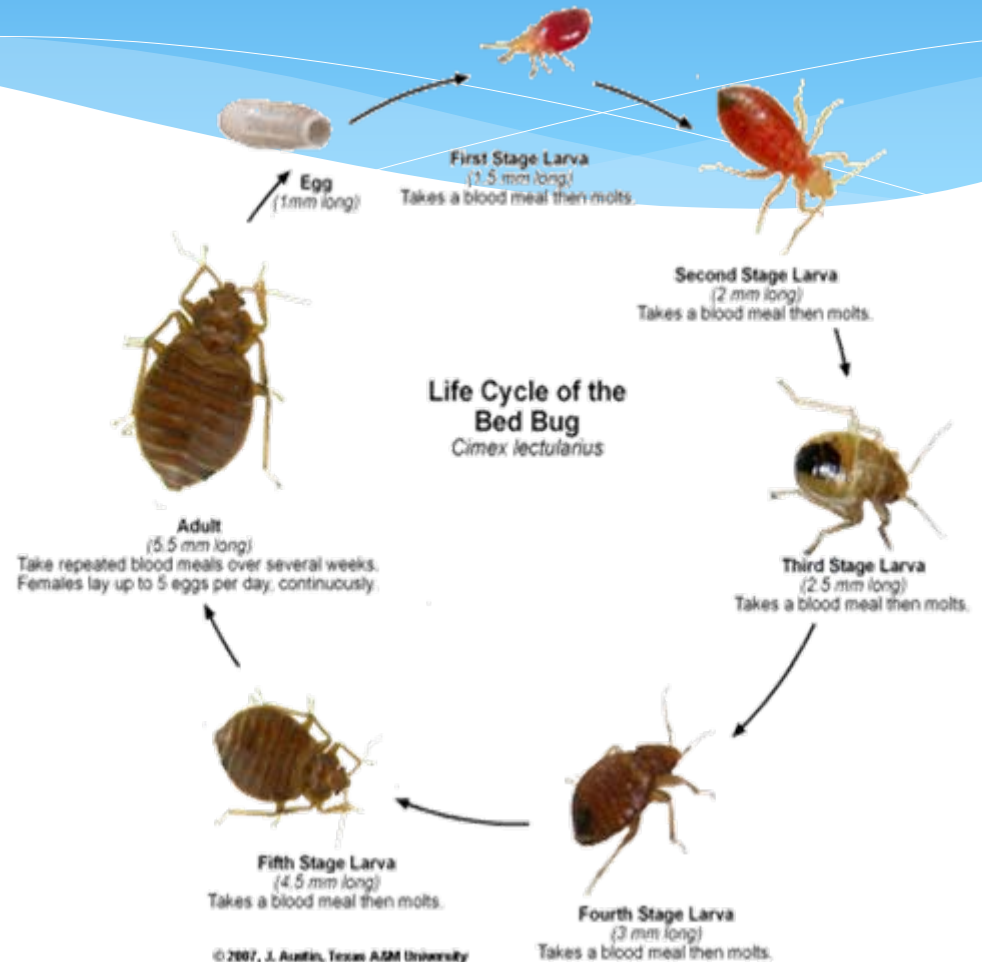
7-10 days

# Bed Bug Life Cycle: The Nymph

- \* Nymphs are white to pale yellow but turn slightly red after a blood meal
- \* Nymphs pass through **5 instars**, each requiring a blood meal to molt to the next stage
- \* The 5 nymphal stages usually last 30 – 48 days
- \* Can last as long as 5 months

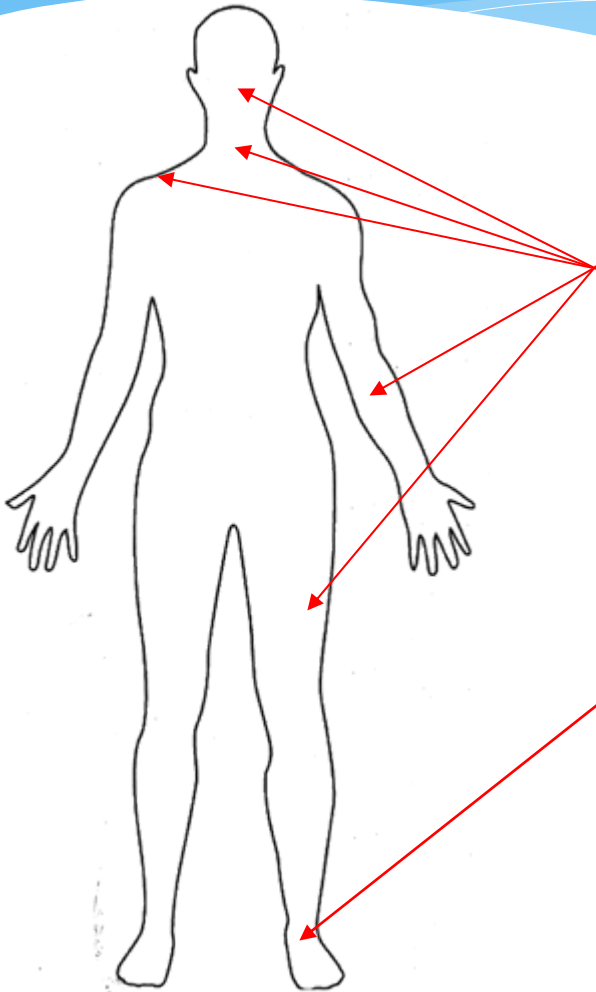


Bed bug exuviae (molt)





# Bed Bug Biology: Bites



**Bed bugs feed on any skin exposed while sleeping (face, neck, shoulders, back, arms, legs, etc.)**



**Flea bites occur mainly around the ankles**

# Bed Bug Biology: How Do They Feed?

- \* Mouthparts modified into needle- like stylet (piercing sucking)
- \* Front legs clasp the skin
- \* Stylet inserted into blood vessel
- \* Anti-coagulant is introduced
- \* Inject saliva and withdraw blood
- \* Bites are usually not noticed



# Bed Bug Biology: Nymph Size



**1<sup>st</sup>. Instar bed bug nymph with fresh blood meal. Note size: about the size of the head of a pin!**

Sorkin and Mercurio. American Museum of Natural History.

# Bed Bug Life Cycle: Mating and Reproduction

- \* “*Traumatic Insemination*”
  - \* Male mates by puncturing female with his copulatory organ, **mere**
  - \* He then injects sperm into her most often in a copulatory called the **para-genital sinus**.
- \* Females will mate 36 hours after a blood meal.
- \* Females can be mated up to 5x per day.
- \* They can die from extreme mating
- \* Males do not mate if starved for more than 2 weeks



Photo: Roger Ignell.

# Bed Bug Biology: Bite Reaction

- \* Reactions vary person to person and range from no reaction to inflamed wheal with intense itching
- \* Reaction caused by anti-coagulant in saliva injected during bite
- \* Easily misdiagnosed with other arthropod bites (flea, mosquito scabies mites)



Photo credit: T Nishimura. BASF

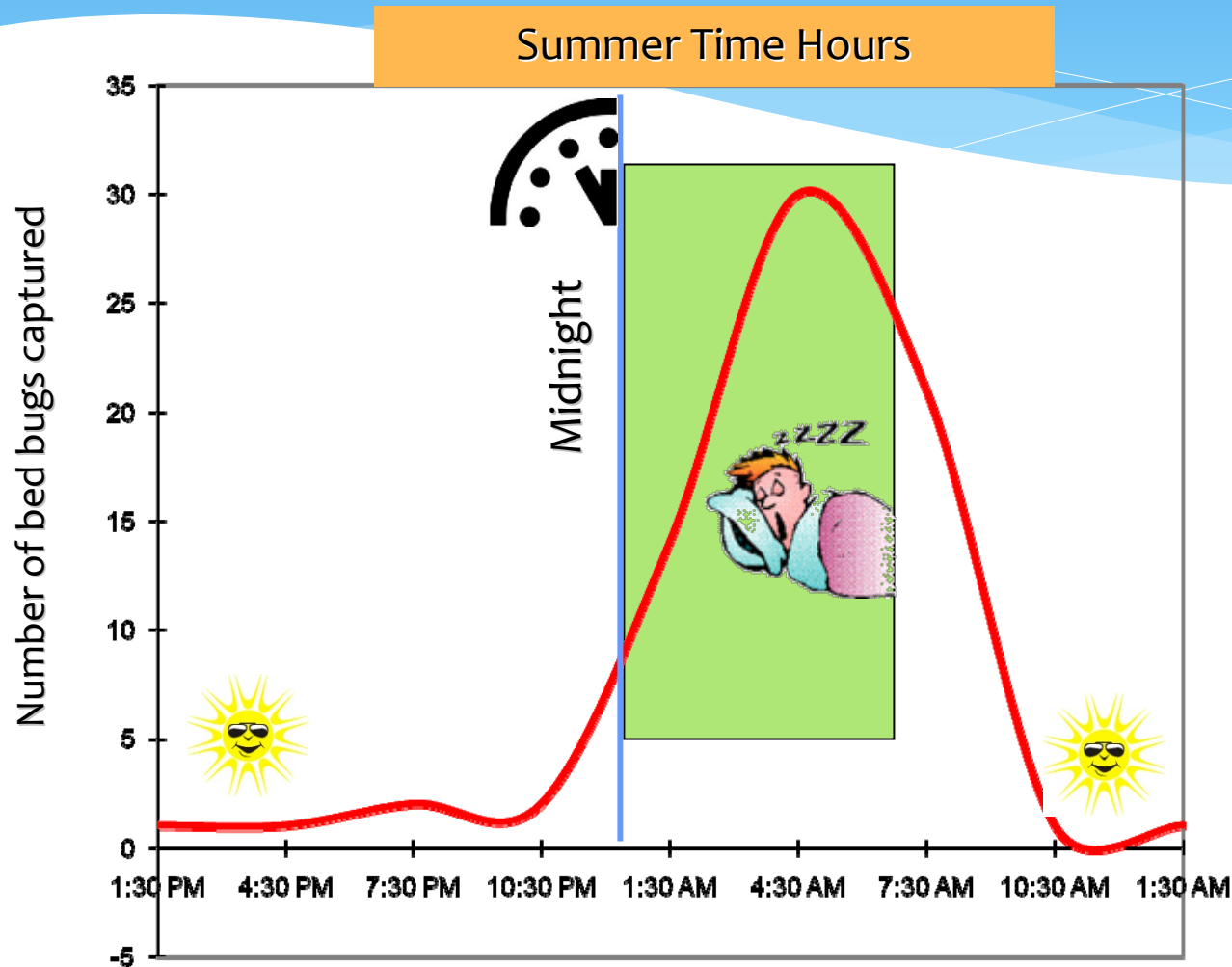


# Bed Bug Biology: Feeding & Host Selection

- \* They do not live on the host but only contact them for a blood meal
- \* Find hosts using multiple cues including CO<sub>2</sub>, heat and host kairomones
- \* Most feeding is at night (12-3 AM) but can be daytime if starved
  - \* Feeding event takes 3-10 minutes
  - \* They *do not feed* every night even if the host is available
- \* Can survive long periods of time (nymphs 3-4 months and adults 1 year) without feeding
- \* Humans are preferred food source but alternate vertebrate hosts are:
  - \* Pets (cats, dogs, birds)
  - \* Hamsters, gerbils, guinea pigs
  - \* Mice, rats, rabbits



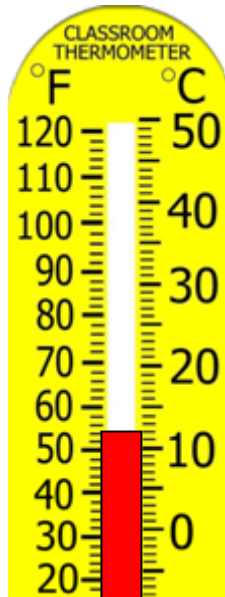
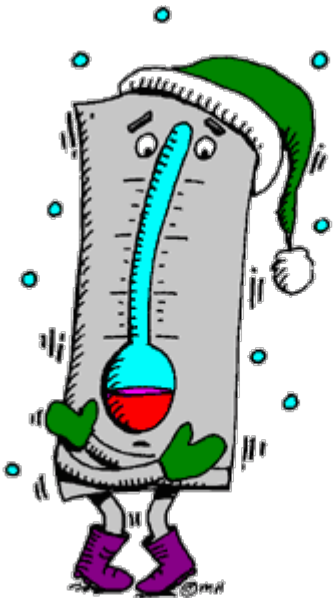
# Bed Bug Activity: Susceptibility of Host vs. Time of Day



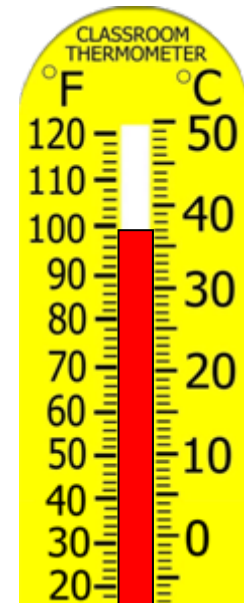
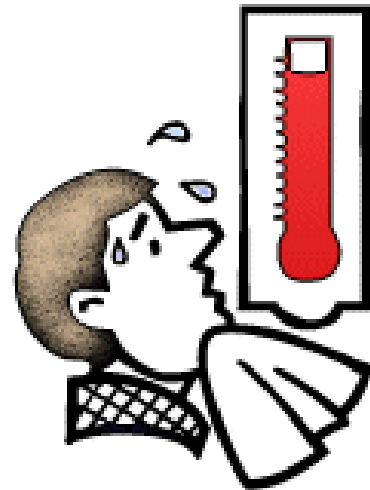
Adapted from Univ. Florida. Dept. of Entomology. Urban Entomology Lab.

# Bed bug Biology: Effect of Temperature on Development

Development



**Below** 55° F

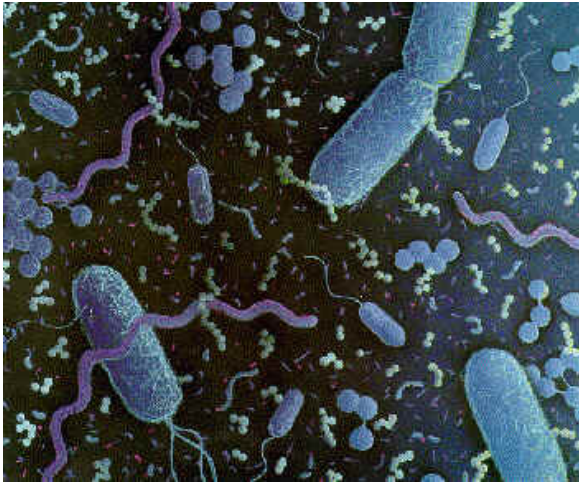


**Above** 99° F

# Bed Bug: Human Health Issues

## Disease Vector ?

- \* Have been found naturally infected with many disease causing organisms isolated from the exoskeleton
- \* No evidence of transmission... to date!



Louis De Vos. University of Bruxelles. Belgium.

# Bed Bug Biology: Result of Feeding - Fecal Smears



**Undigested blood is the cause of “fecal” stains which are easily visible.**

**Half the blood taken in a feeding event is excreted within 5 hours of feeding.**







# Detection: Real and Presumed Evidence of Bed Bug Infestations

You don't have to see a live bed bug to know that you have a problem! Experienced technicians will rely on several visual clues and a peculiar odor during inspections.

- \* Live bed bugs
- \* Eggs and cast skins
- \* Bite reactions
- \* Blood spots on linens and mattresses
- \* Blood smears on walls
- \* A Pungent sweet odor (?)



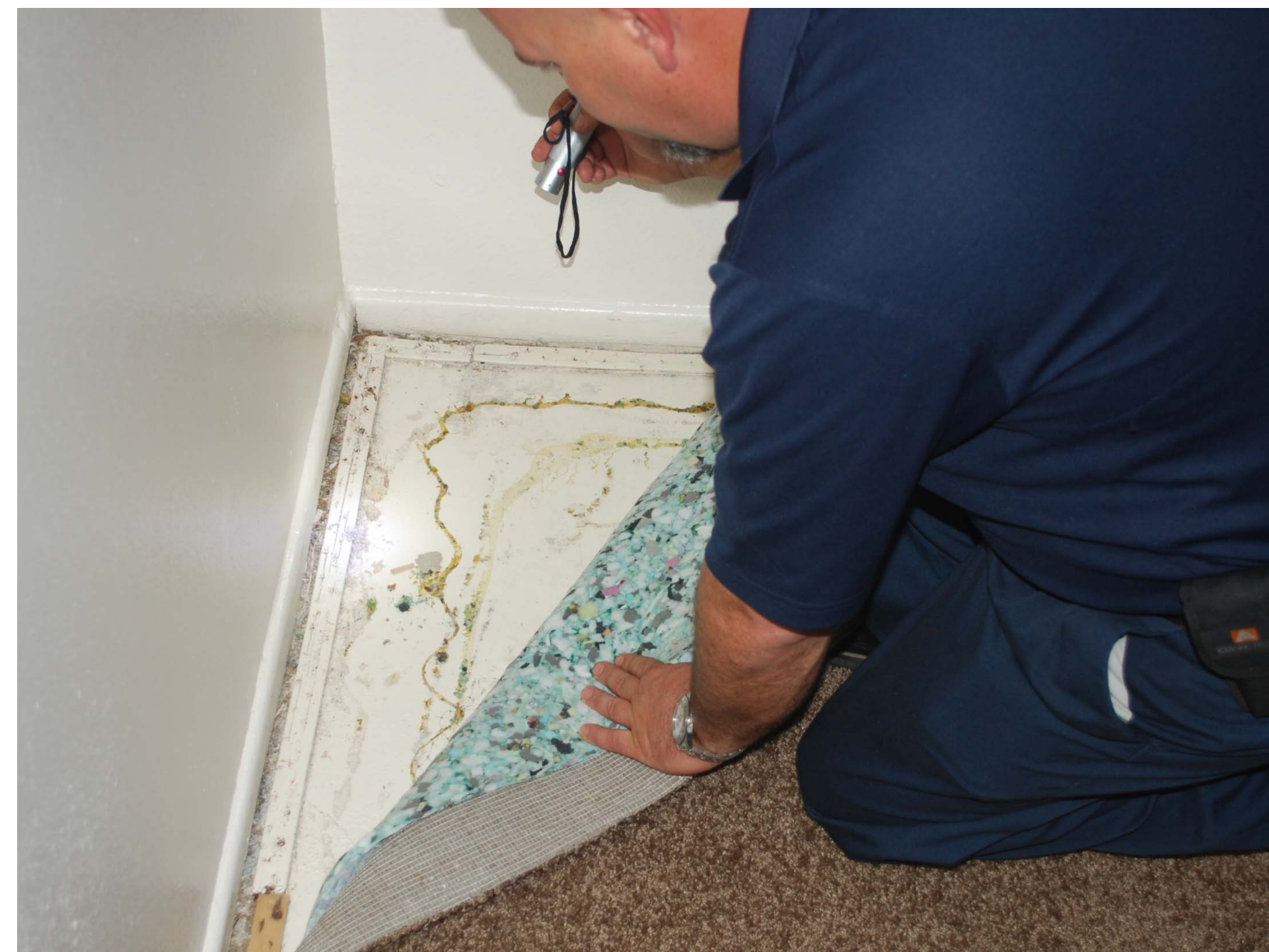
Fecal smears are a **signature** mark of bed bug infestations.











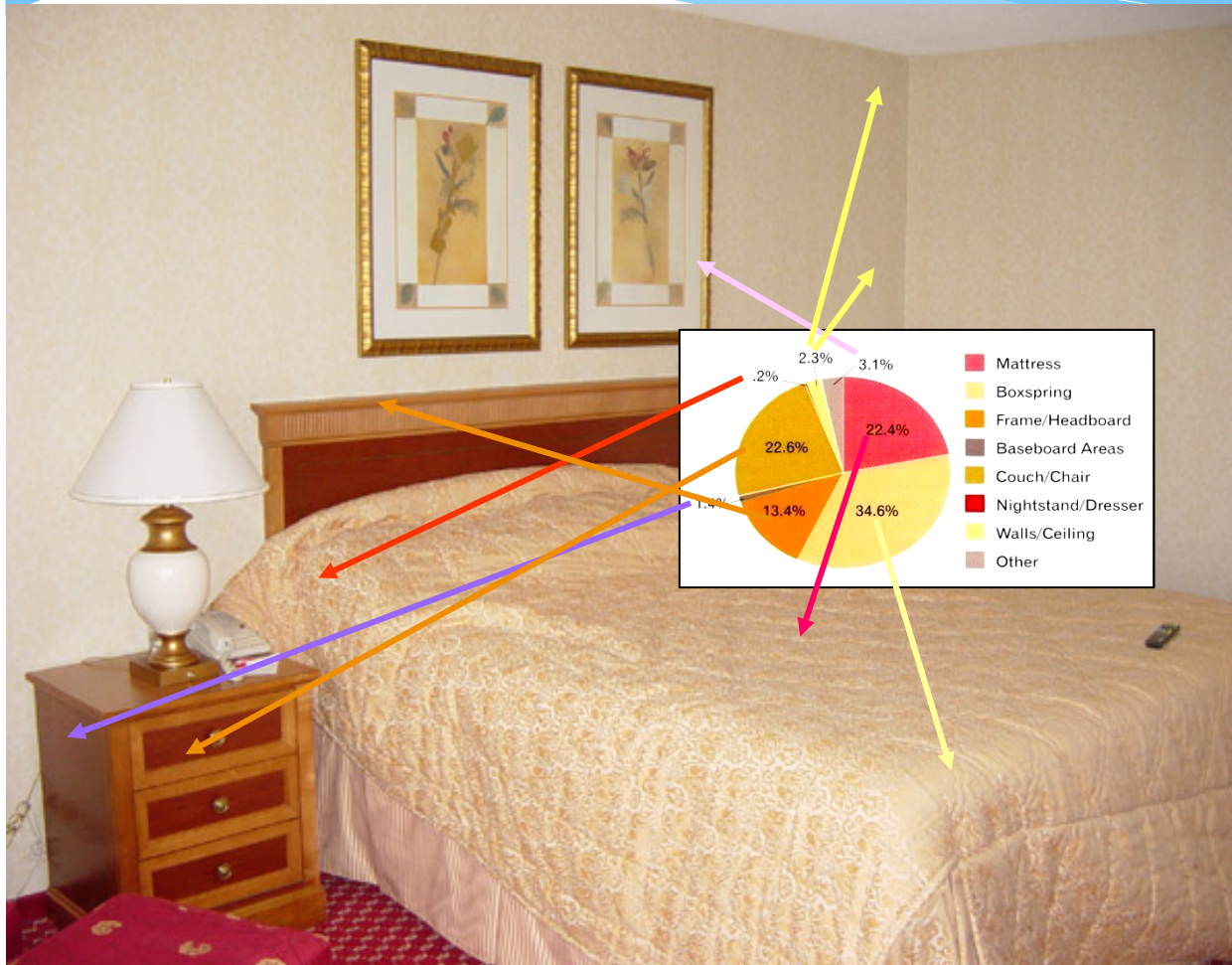
# Bed Bug Behavior: Harborage Sites & Aggregation

- \* Bed bugs often cluster together and spend as **much as 90%** of their life in harborage areas. All stages of growth will be present.
- \* Aggregation pheromones for this behavior
- \* Inhabit areas of least disruption
- \* Prefer semi-darkness
- \* Do not like “drafts” or air currents
- \* Prefer dry and rough substrates





# Treat Bed Bugs Where They are Found

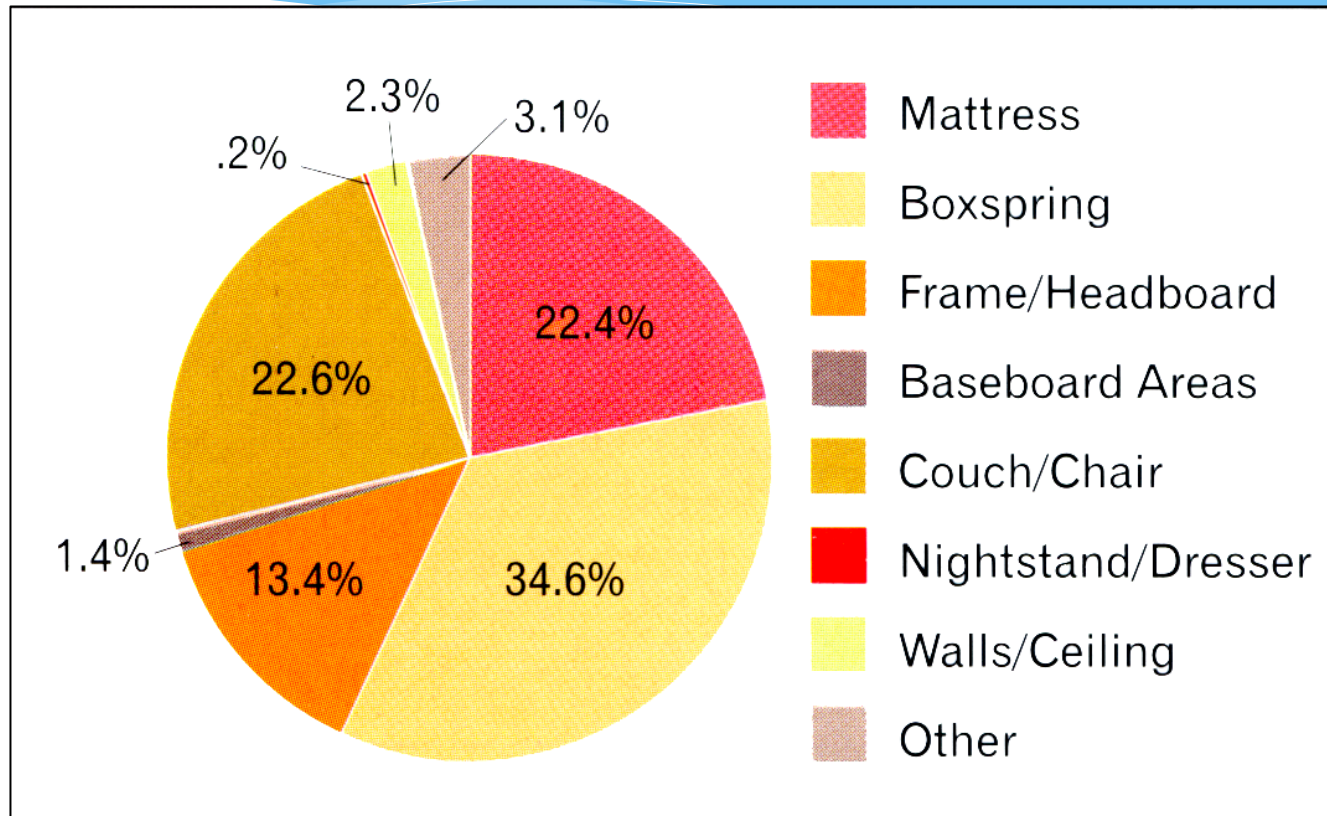


Ensure pesticide labels include sites to be treated

Follow all label directions and precautions



# Bed Bug Inspection: Hiding Spots



Survey of 13 apartments; Source: *PCT. Battling Bed Bugs in Apartments*. Univ. of Kentucky. Potter, Romero, Haynes, Wickenmeyer.





# Control Strategies

The slide features a blue header bar at the top. Below the header, there are several overlapping, wavy, light blue shapes that create a sense of depth and movement, resembling stylized waves or layers of a landscape.

# Management Strategies and IPM- What to do

- \* Locate all of their hiding places
  - 1) Dismantle the bed: mattress, box spring, bed frame and headboard
  - 2) Inspect all bedroom furniture
  - 3) Pictures, mirrors, curtains, wall mounts
  - 4) Baseboard/carpet, wallpaper, decorative borders
  - 5) Check attics, eaves and roof overhangs for bat or bird activity
  - 6) Flashlight, sticky traps, “flushing agent”



# Treatments

## \* Non-Chemical

- 1) Laundry (hot soapy water/clothes dryer)
- 2) Dry clean or replace
- 3) Freezer (2 weeks)
- 4) Sanitize or discard mattress/box spring
- 5) Steam cleaning/HEAT-structures (Thermal)
- 6) Vacuuming, caulking, loose wallpaper
- 7) Monitors (passive or active)
- 8) Canines-use with visual inspections
- 9) Encasement

# Treatment Procedures

- \* Chemical

- 1) Read the label and make sure its legal
- 2) A thorough application is essential to achieve adequate control
- 3) Crack and crevice treatment with insecticide dusts may be most important step
- 4) One application may not solve problem

# Treatment Procedures

- \* Chemical

- 1) Crack and Crevice

- Dusts, Aerosols, and ECs

- 2) Fumigation (-Sulfuryl fluoride (Vikane))

- 3) Space and Surface Sprays-See C and C

# Bed Bugs: Key Control Issues(?)

- \* Pyrethroid resistance
- \* Repellency
- \* Quick kill (no residual) vs residual kill (slow-acting)
- \* Multiple Applications and combination of products
- \* Label restrictions
- \* IPM
- \* Curative vs. preventive treatments

# The “Client”

- \* Who's the client
- \* Conflicts –tenant vs owner
- \* “Specialized Service”
- \* Mystery bites-get a sample
- \* Proper preparation-verbal, written, bilingual
- \* Clutter
- \* Document, document, document



# Client

- \* Special needs- Healthcare facilities, schools
- \* Written procedures-protocols and training for nursing staff and doctors.

# The Spread

- \* Everywhere-(name a town that does not have BB even CNN)
- \* Example of 1 female- over 31,000 individuals after 6 months
- \* Avoidance –equipment or changing clothes
- \* Remember The PMP should be the PROFESSIONAL
- \* Get the label and Read it!!!!

# Summary

- \* No magic bullet
- \* Not going away soon
- \* Communication will be increasing more important
- \* Chemical and non-chemical control tactics
- \* Document, document and document