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

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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.

- Termites
- Cockroaches
- Ants
- Bed bugs

Percent of Respondents
Bed bugs 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

* Potter, Pest Mgmt Prof. Jan. 2008
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
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.
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.

Kendall Bioresearch Services. Bristol, UK.

Walter Dioni. Cancun, Quintana Roo. Mexico.
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 are 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.
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.
**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

1st. 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 CO₂, 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!

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

*Insure pesticide labels include sites to be treated*

*Follow all label directions and precautions*
Bed Bug Inspection: Hiding Spots

Control Strategies
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”
* 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 it's 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!!!!!
No magic bullet
Not going away soon
Communication will be increasing more important
Chemical and non-chemical control tactics
Document, document and document