

Cuyahoga County Bed Bug Conference
November 15, 2012

What's New?

A Bed Bug Research Update



Presented by:
John Gedeon, Jr. R.S.
The General Pest Control Co.
Cleveland, OH





Peter J. Hotez, MD, PhD,
Baylor College of Medicine

Why Do Research?

"Just as with other global diseases once thought under control and then neglected, bed bugs have shown the same ability to resurge in great numbers once our vigilance wanes."

"To stay one step ahead of bed bugs and other disease organisms, we need to sustain investment in research for new tools."



Why Do Research?

“There is a lack of understanding of the ecology and biology of bed bugs, which is essential for control.”

“This lack of knowledge is not surprising; bedbugs had virtually disappeared as a significant pest in the western world for many decades.”

Going into the 21st century we were about 50 years behind in research



Stephen Doggett
Dept. of Medical Entomology
University of Sydney



What is “research”?

research:

A diligent and systematic inquiry or investigation into a subject in order to discover or revise facts, theories, applications, etc.



What is “research”?

Pure (basic) Research: is research carried out to increase understanding of fundamental principles. It is not intended to yield immediate commercial benefits; pure research can be thought of as arising out of curiosity. Pure research is mainly carried out by universities

Applied Research: the practical application of science. Applied research deals with solving practical problems in the messy real world.

Source: wikipedia



Who Is Doing Research?



Who is doing the research ?



Susan Jones, PhD
Ohio State University
In a laboratory



Lou Sorkin, B.C.E.
American Museum of Natural History
Feeding Bed Bugs



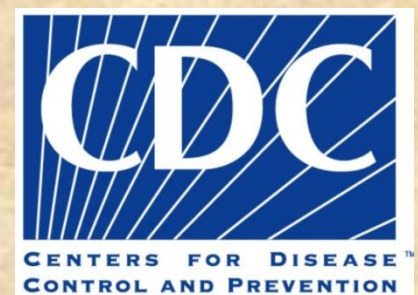
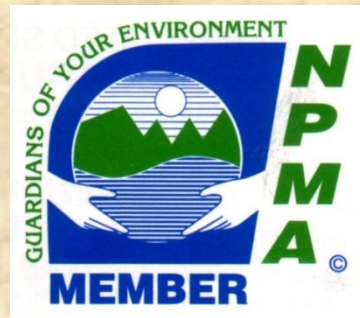
Tim Gibb, Insect Specialist
Purdue University



Dini Miller, PhD
Virginia Tech University
Inspecting a bed



Where Is Research Presented or Published?



1. Do Total Release Foggers Work Against Bed Bugs?

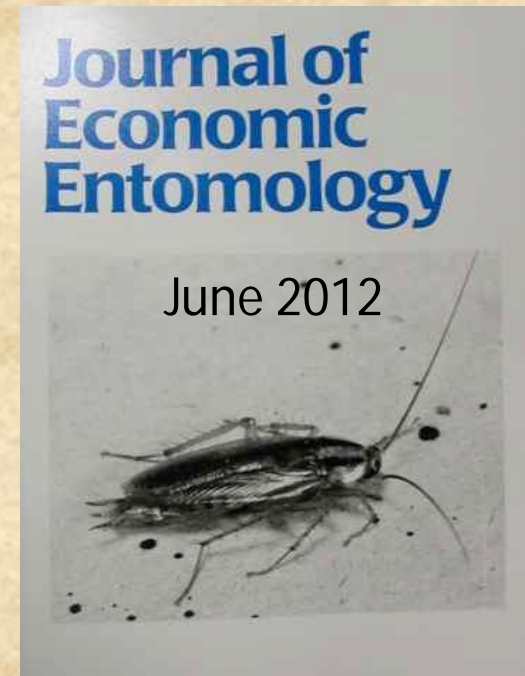


Susan Jones, PhD
The Ohio State University

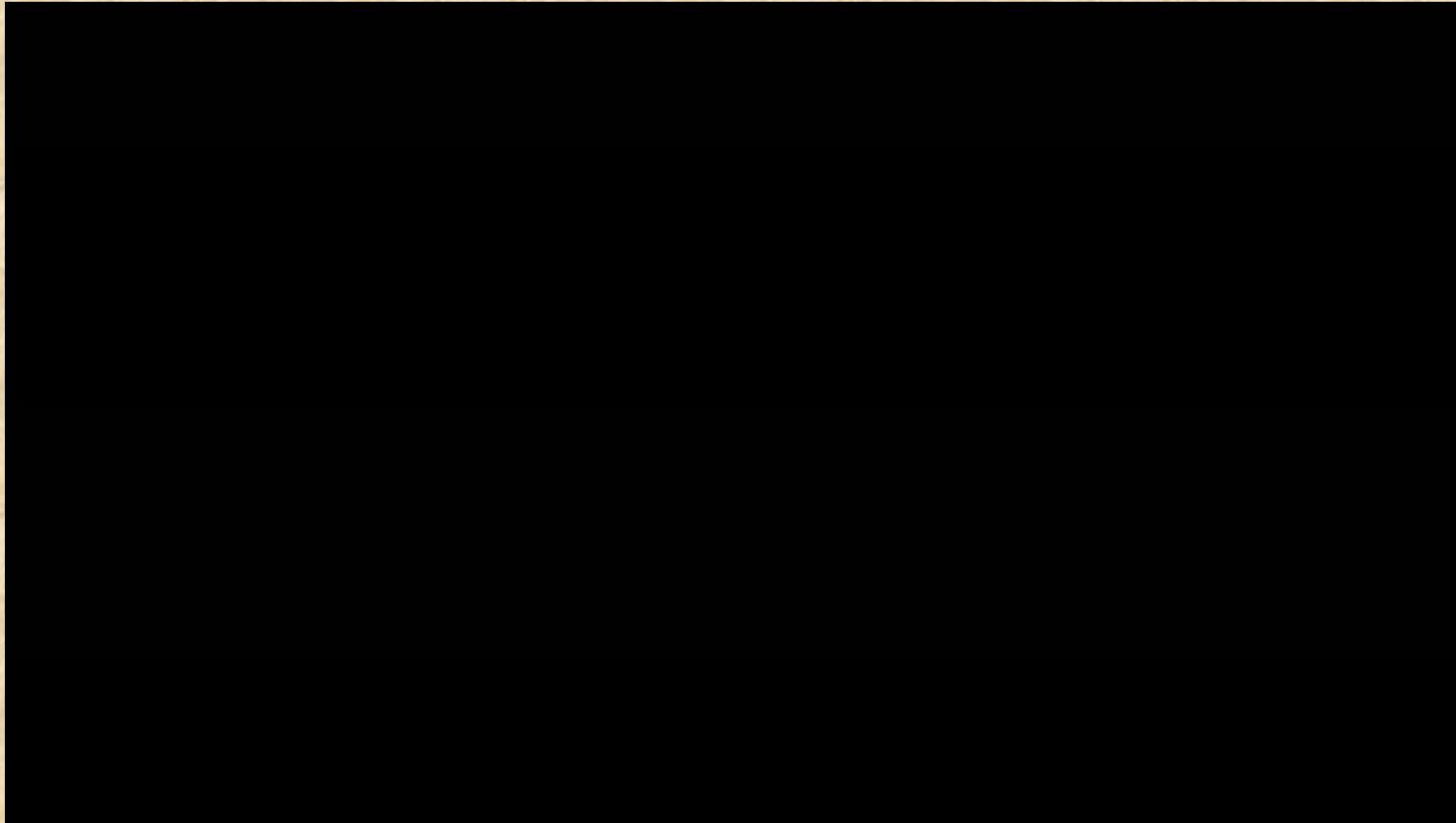
1. Do Total Release Foggers Work Against Bed Bugs?

The Study Method:

- 3 different brands of foggers
- bed bugs collected from the Columbus area
- bed bugs from the Harlan strain – susceptible control group
- bed bugs placed out in the open
- bed bugs covered by thin layer of cloth
- fogger activated
- collect and analyze specimens



1. Do Total Release Foggers Work Against Bed Bugs?



Susan Jones, PhD
Ohio State University



1. Do Total Release Foggers Work Against Bed Bugs?

Major Findings:

1.the research supports the view that total-release foggers lack the ability to penetrate into typical harborages used by many household insects, therefore rendering these products ineffective as control agents.

2. Field-collected bed bugs typically were not affected by direct exposure for 2 hours to the fog....hence pyrethroid resistance appears to play a role in the foggers failure to kill bed bugs

3. The potential behavioral effect* of foggers on bed bugs needs to be evaluated as it may increase the difficulties associated with bed bug control.

*increased locomotor activity



2. Know Your Enemy – The Ecology, Behavior, & Immunity of Bed Bugs

Why Study Bed Bugs
If Not to Find Ways To Kill Them?

Basic (pure) research over the last
20 years focusing on:

How is the bed bug vulnerable?



Michael Siva-Jothy, PhD
University of Sheffield
(England)



2. Know Your Enemy – The Ecology, Behavior, & Immunity of Bed Bugs

Some Findings:

Immune System: the female bed bug has an immune system that produces proteins and other substances to offset microbes (germs) encountered as a result of feeding, mating, and living in a very hostile environment.



2. Know Your Enemy – The Ecology, Behavior, & Immunity of Bed Bugs

Other Findings:

Refuge Dynamics (where they go to hide)

- The more habitat that is available (stuff and clutter) the more likely they are to move out to fill the space

- The more habitat there is for bed bugs the less likely they are to disperse - because they have lots of places to hide.

- The presence and abundance of males in the environment did not seem to cause females to disperse away from the feeding site.



2. Know Your Enemy – The Ecology, Behavior, & Immunity of Bed Bugs

What does his 20 years of research mean?

Science still does not know why the bed bug does what it does.

- Why does it go to certain harborage
- Why does it disperse
- How does it survive

It may be 10 to 15 years before this research can be developed into control materials and methods.



3. Detection and Dispersal of Bed Bugs in Multi-Family Housing



Rick Cooper, MS & PhD Candidate
Rutgers University

The Study (part 1): Detection

- Affordable Housing for Elderly
- 224 apartments
- 16 units known to have bed bugs
- ClimbUp Interceptors + Visual Inspection

The Method

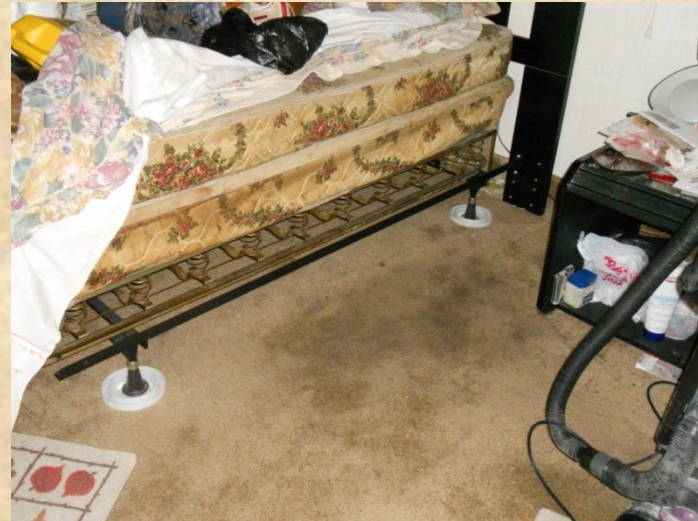
- Placed interceptors in all apartments
- Follow up inspection 14 days later
- If no bed bugs were found – then a visual inspection was made



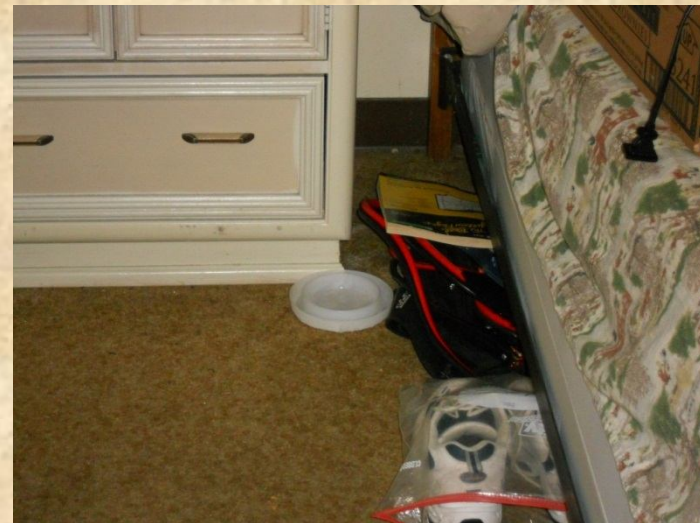
3. Detection and Dispersal of Bed Bugs



32
interceptors
per
apartment



CLIMBUP
INSECT INTERCEPTOR



3. Detection and Dispersal of Bed Bugs

The Findings:

16 known infestations were confirmed with interceptor traps

+39 new infestations were found

55 of the 232 apartments were infested

Of the 55 - 51 of them were detected by the interceptors

4 were found by visual inspection



3. Detection and Dispersal of Bed Bugs

The Relevance

1. Interceptors are very good at capturing bed bugs that wander in an apartment.
2. 71% of the apartments (39 of 55) with bed bugs failed to report the infestation to management.



3. Detection and Dispersal of Bed Bugs

More Findings: What was trapped?

- 84% of bed bugs in traps were nymphs
- 80% of nymphs were 1st & 2nd instars



Bed Bug Life Cycle



3. Detection and Dispersal of Bed Bugs

Conclusion:

- ✓ Interceptors are more effective than visual inspections for determining the presence/absence of bed bugs.
- ✓ Interceptors can detect low levels of bed bug infestations
- ✓ Interceptors remove bed bugs and help to provide immediate relief



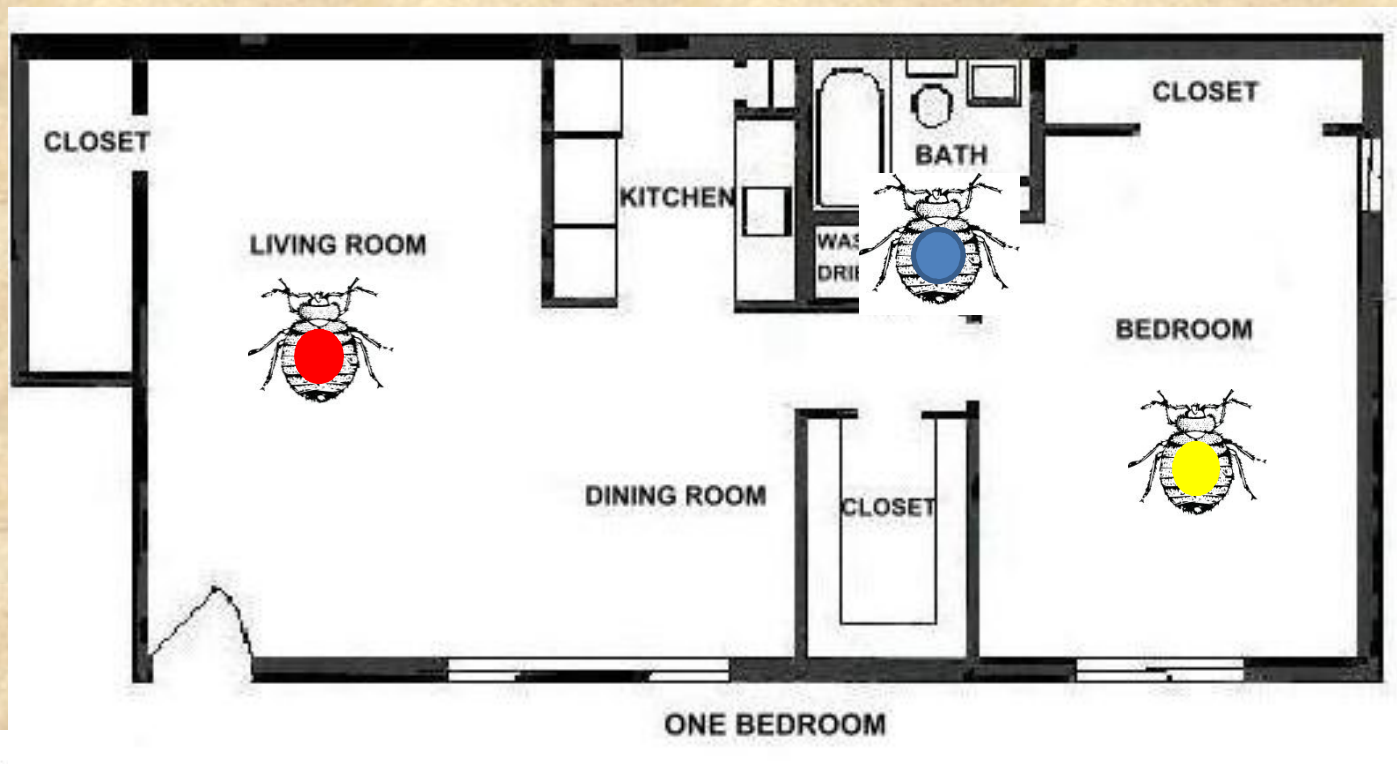
Rick Cooper, PhD Candidate
Rutgers University



3. Detection and Dispersal of Bed Bugs

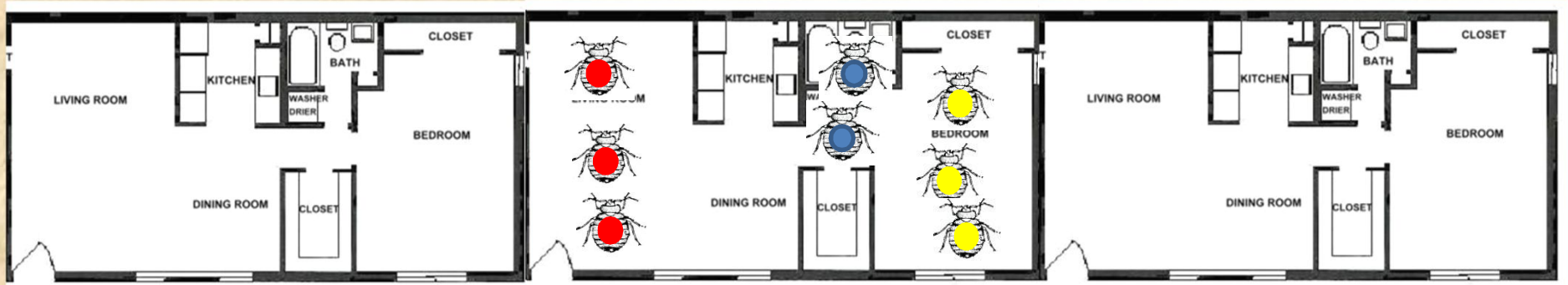
The Study (Part 2): Dispersal (wandering)

- captured bed bugs in one apartment
- marked bed bugs with colors
- released bed bugs
- recovered bed bugs



3. Detection and Dispersal of Bed Bugs

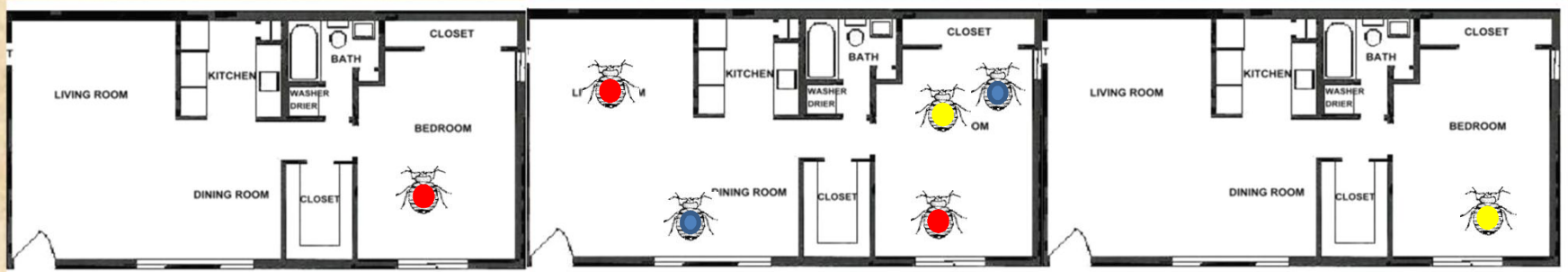
What Happened? (a simulation)



Hallway



3. Detection and Dispersal of Bed Bugs



Hallway

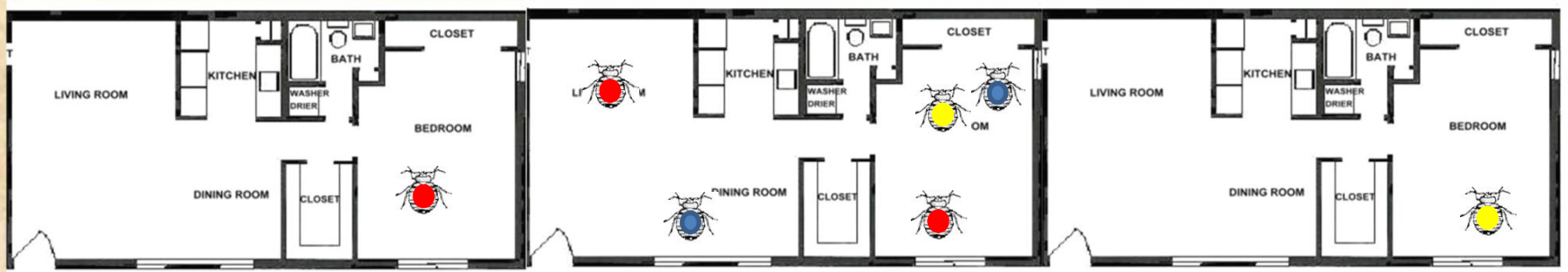


Findings:

Active Dispersal: bed bugs move more that what we thought.
However, the reasons and the pathway is unclear.
– more research needed



3. Detection and Dispersal of Bed Bugs



Hallway



Cooper's Take Home Message:

If you are not inspecting the adjacent apartments, you may be missing additional infestations.



4. Human Host Kairomones

What is a kairomone?

Dictionary Definition: *a chemical substance emitted by one species that has an adaptive benefit to another species*



Steven Kells, PhD
University of Minnesota

Quite simply, a chemical released by humans that benefits bed bugs



4. Human Host Kairomones

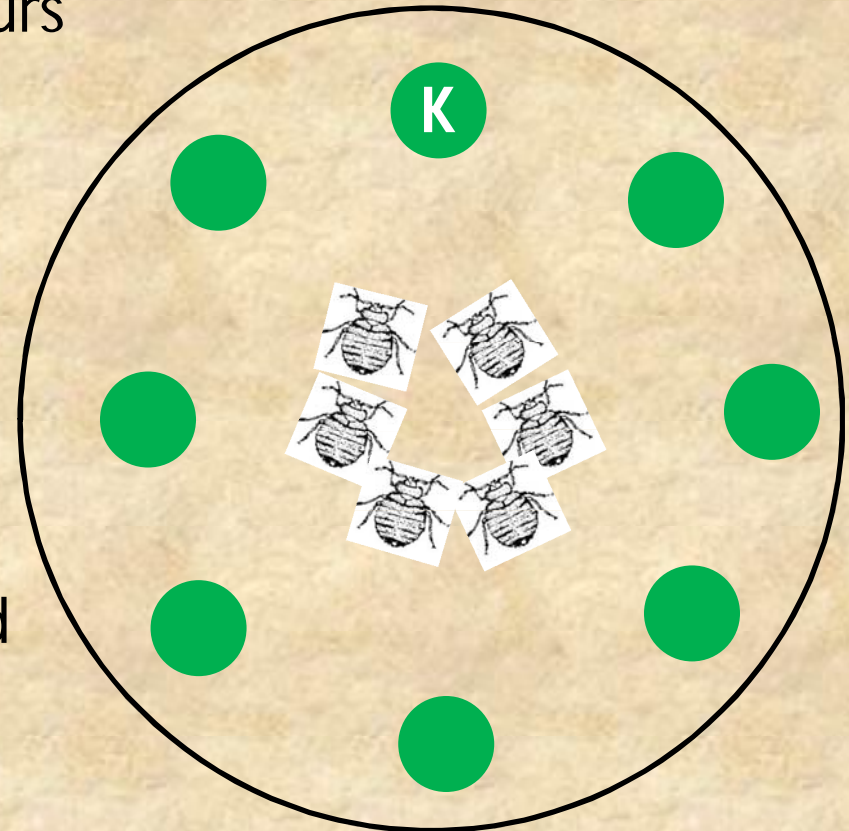
The Study Methodology:

- Fabric pad worn in a shoe for 8 hours
- Pad placed in arena
- 7 other “clean pads”
- Release bed bugs in center
- Observe activity

Findings:

- ✓ Most bed bugs moved to the K pad
- ✓ Stayed longer at the K pad

Bed Bug Test Arena
(a simulation)



4. Human Host Kairomones

The Relevance

1. Human odor (kairomone) plays a role in bed bug movement
2. Unwashed clothes (strewn about) and our personal stuff with our kairomones appear to be an attractive harborage for bed bugs



Personal items with human kairomone

Unwashed clothes loosely strewn



Personal items with human kairomone



5. Will Cold Temperature Kill Bed Bugs?

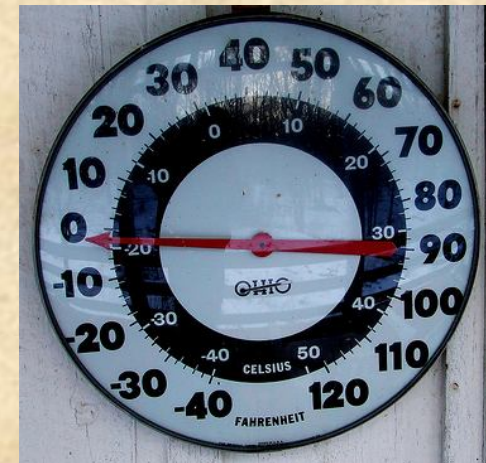


5. Will Cold Temperature Kill Bed Bugs?

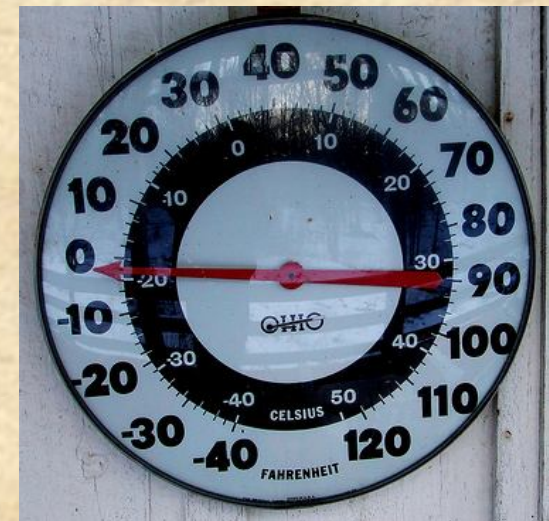
Yes, but

0° F for 3 days – uninterrupted cold

-11° F for 2 days – uninterrupted cold



5. Will Cold Temperature Kill Bed Bugs?



5. Will Cold Temperature Kill Bed Bugs?

Conclusions:

- Be aware of the insulating effects of fabric and upholstery.
- Outdoors, it may not be cold enough, long enough to kill.
- A freezer with controlled temperature may be more effective.

Remember: 0° F – 3 days



6. Can Drinking Wine Keep Bed Bugs Away?

Ralph Narain,
PhD Candidate
Univ. of Nebraska



How do you study this?

- Prepared blood as feeding samples: some with alcohol and one control (no alcohol)
- Fed bed bugs from the samples
- Measured feeding and egg production



6. Can Drinking a Glass of Wine Keep Bed Bugs Away?

Findings:

- Bed bugs from control (no alcohol) fed the most
- Bed bugs fed with 0.10% alcohol fed the least

- Bed bugs from control group laid 44 eggs on average
- Bed bugs with 0.10% BAC laid an average of 12 eggs



Conclusion:

1. Bed bugs may prefer alcohol free blood
2. The higher the BAC, the less bed bugs feed
3. The higher the BAC, the fewer eggs are laid

6. Can Drinking a Glass of Wine Keep Bed Bugs Away?

Interpretation:

Drinking before bedtime is not going to control an infestation. Bed bug may consume less blood and lay fewer eggs



BUT they still are there!

May add new meaning to the rhyme "Sleep tight....."

"tight" – one definition in the dictionary is
"somewhat drunk"



7. DNA Testing to Verify a Bed Bug Infestation

**DNA TESTING
FOR FINDING
BED BUGS
WITH 99.9%
ACCURACY!**

[Click here for more information](#)

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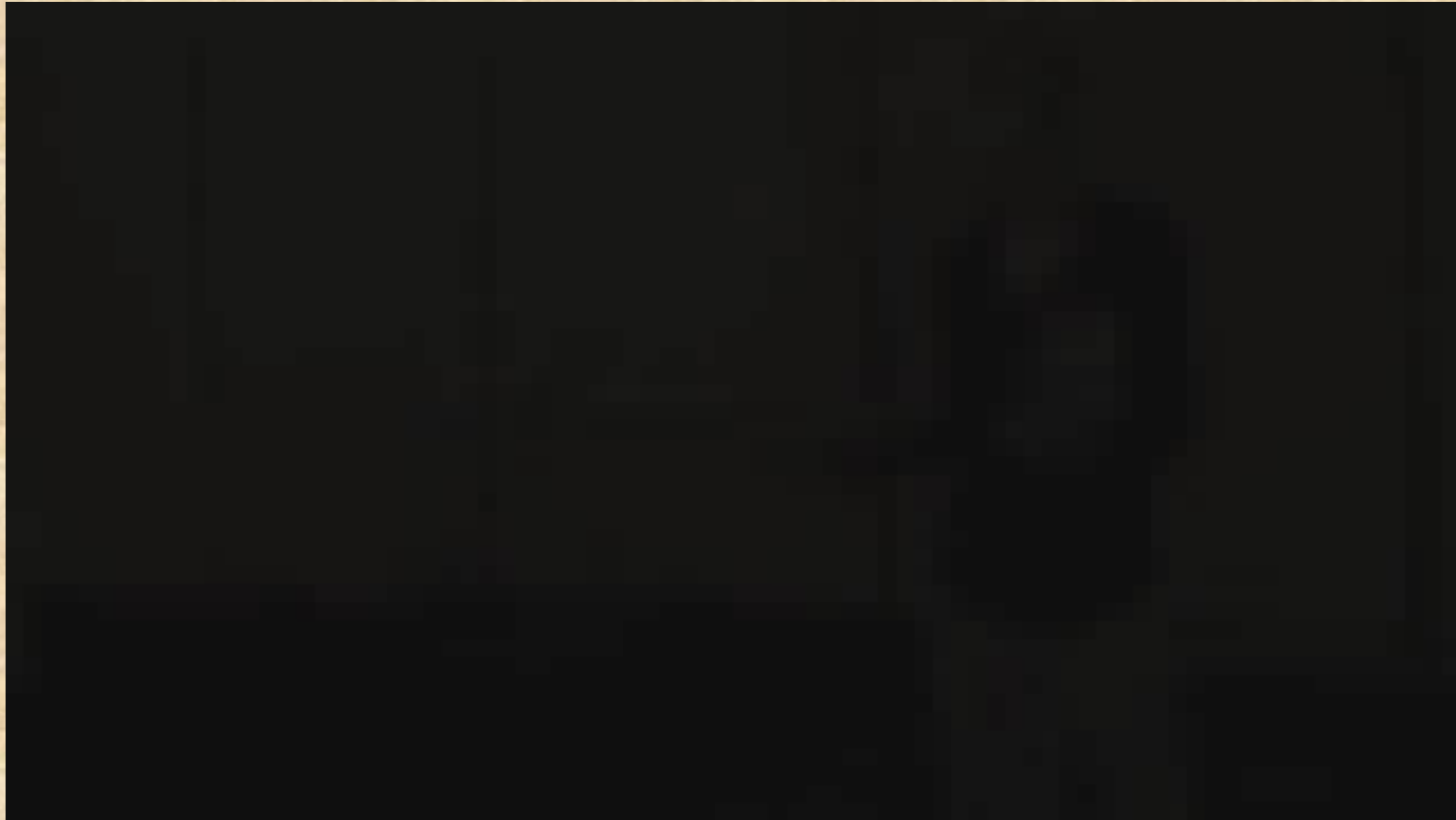
Industrial & Scientific > Bug-Test Bed Bug Home Test Kit

Showing 1 Result

1.  **Bed Bug Home Test Kit**
Buy new: **\$29.99**
In Stock



7. DNA Testing to Verify a Bed Bug Infestation



7. DNA Testing to Verify a Bed Bug Infestation

DNA Testing is Accurate – but

- ❖ cannot distinguish between old and new evidence – DNA from a bed bug may last for a year
- ❖ negative results does not mean “no bed bugs”
- ❖ a separate swab must be used for each different area or room you plan to test
- ❖ if a swab test is positive, a visual inspection or interceptor trap inspection should be made to confirm the findings

**DNA TESTING
FOR FINDING
BED BUGS
WITH 99.9%
ACCURACY!**

[Click here for more information](#)

Just another tool



8. Using DNA to Determine Source and Spread of Bed Bugs in multi family apartment buildings



Ed Vargo, PhD
NC State University

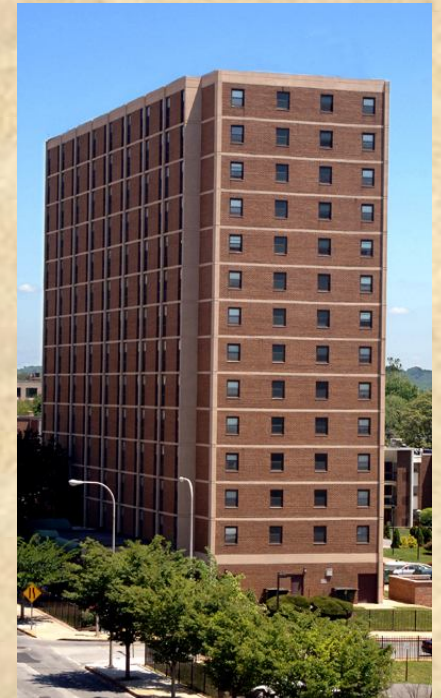
The Study Question:

How often are “new” bed bugs being brought into the building?

The Study Method

- Bed bugs collected (all stages)
- Three high rise buildings
 1. Raleigh, NC - 17 suites
 2. Jersey City, NJ (a) – 9 suites
 3. Jersey City, NJ (b) - 5 suites

Analyzed the DNA and other biological markers (very complex science)

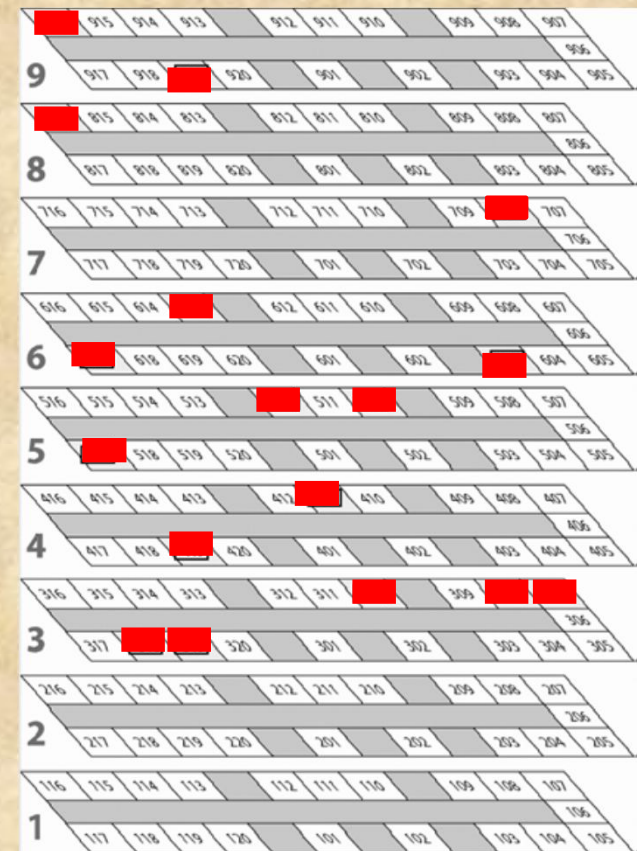


8. Using DNA to Determine Source and Spread of Bed Bugs in multi family apartment buildings

Major Findings

In Raleigh (low genetic diversity) the infestation in the building is likely to have originated from a single introduction and spread from there

In Jersey City (moderate genetic diversity) the infestation in the building is likely to have originated from two separate introductions.



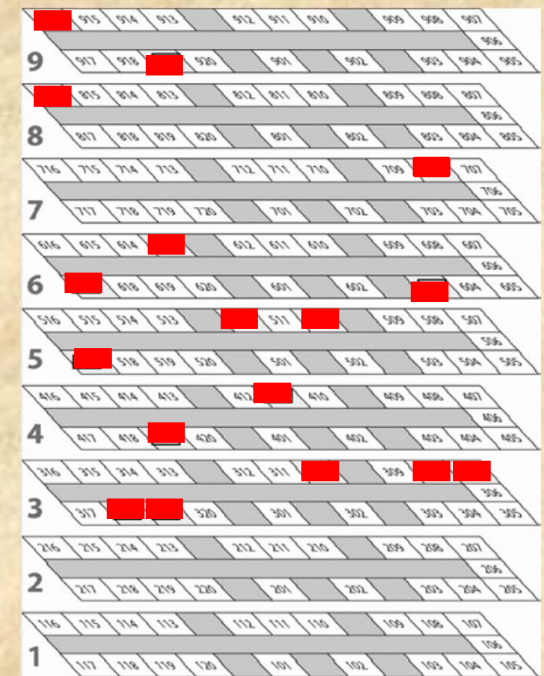
Raleigh – 17 suites



8. Using DNA to Determine Source and Spread of Bed Bugs in multi family apartment buildings

Conclusions

- Within a building the infestations are likely to have been from a single introduction.
- There is considerable in-breeding among the bed bugs, the results of which needs further research.
- The DNA similarity among the bed bugs throughout the building confirms that there is both active dispersal and passive dispersal.



Raleigh – 17 suites



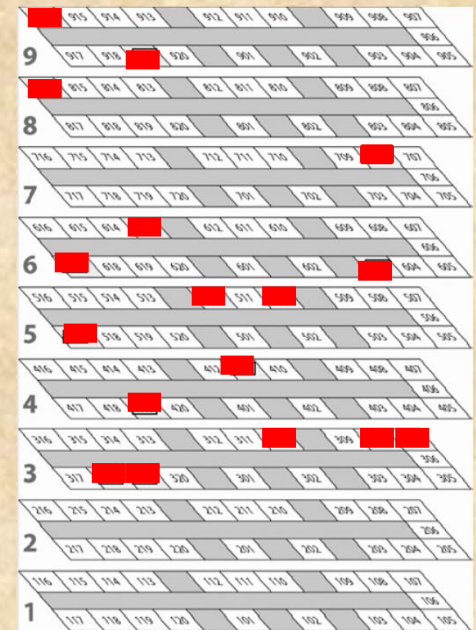
8. Using DNA to Determine Source and Spread of Bed Bugs in multi family apartment buildings

What does this mean

When introduced infrequently, the control effort needs to be put into early detection.

When introduced frequently (in cities with high levels of infestation) the control effort needs to be put into prevention (stop them at the door)

People (residents, guests, visitors, etc) move bed bugs around a lot more than previously had been thought.



Raleigh – 17 suites



A Concluding Observation & Comment

Regarding the bed bug problem, there is no silver bullet. This bug is the “Houdini of the insect world.” It has an amazing ability to adapt to the insecticides that are sprayed on it.

The bed bug problem is alive and well and I just do not see any way we are going to get out of this thing anytime in the near future.



Mike Potter, PhD.
Univ. of Kentucky

What's the solution?



Funding for More Research!



Questions / Comments



