

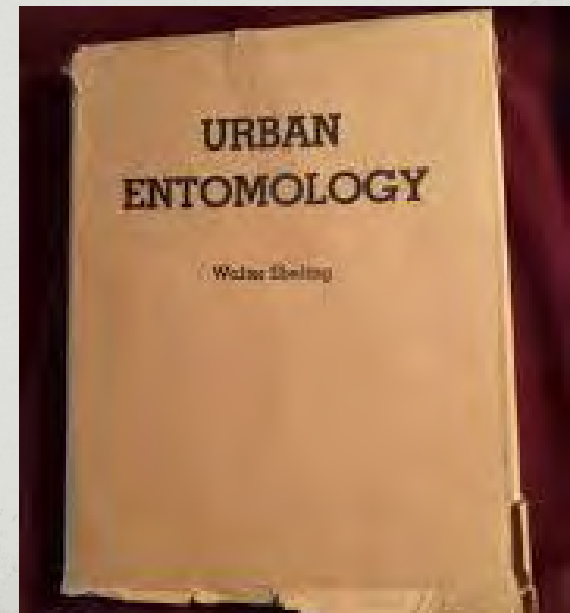
Master Gardeners are Important in Sharing Indoor IPM Information

Faith M. Oi
foi@ufl.edu

"This work is supported by the Crop Protection and Pest Management Extension Implementation Project, grant no. 2017-70006-27149/project accession no. 1013962 from the USDA National Institute of Food and Agriculture."

Happy 40th birthday, Florida Master Gardeners!

- Coincidentally, the field of urban entomology is in the same age-class, if we mark its birth by Walter Ebeling's landmark book aptly titled "Urban Entomology" published in 1978.



Master gardeners are ideal messengers for IPM

- You actively participate in community and school garden projects that can include IPM.
- You provide educational programs to the public using science-based information and are already familiar with many of the pests that invade indoor spaces.

Master gardeners are ideal messengers for IPM

- Today, we will modify the IPM message for pests that can be a problem indoors.
- Do you have FAQs?
- We will post the answers to FAQs at for future reference:
<https://pestsinthhome.extension.org/>

Help please!

<https://pestsinthefhome.extension.org/>

extension
Issues • Innovation • Impact
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PESTS IN THE HOME

Welcome to Pests In and Around the Home Resources ▾ Common Pests ▾ Pest Prevention - IPM ▾ Posts ▾

Welcome to Pests In and Around the Home

This site is a resource for pests in and around the home intended to:

- Answer homeowner pest control questions
- Help you prevent and/or manage common pests
- Recognize human behaviors that cause pest problems
- Know when to call a professional

Integrated pest management is not just the application of pesticides or absence

SEARCH

Search ...

RECENT POSTS

How Control Head Lice Using Integrated Pest Management
August 23, 2019

Seeking individuals to participate in integrated pest management survey
August 23, 2019

“Seeking individuals to participate in integrated pest management survey.”

UF is the lead on this project.

Service program specialist based at the Texas A&M AgriLife Research and Extension Center in Dallas.

Hurley is leading the survey portion of a wider study supporting homeowner integrated pest management, or IPM, programs. Study partners include the University of Florida and Auburn University, with funding provided by the U.S. Department of Agriculture's National Institute of Food and Agriculture.

The study's lead investigator is Faith Oi, Ph.D., University of Florida.

“After more than 40 years of universities providing training to the pest control

IPM

- IPM=Integrated pest management is a proven, dynamic decision-making **process**. However, adoption and implementation rates are low often because “IPM” sounds too academic and unachievable.

Objectives for Today

- 35,000 foot level of indoor IPM
- The importance of pest management
- Information to share with homeowners
- In brief, if you see the following, you may have a pest problem

See Something, Say Something Droppings



Photo credit: R. Bernal

D. Hall

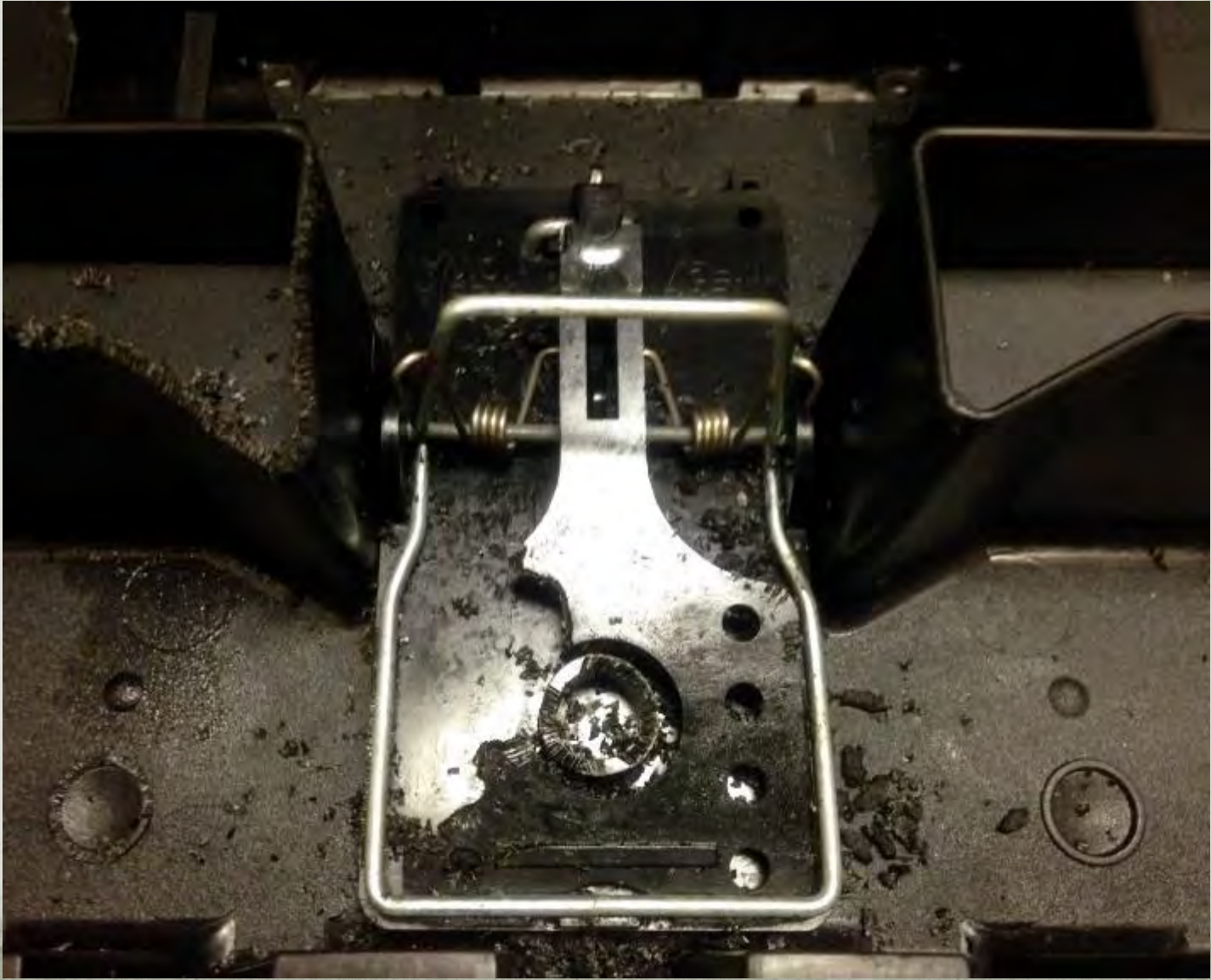
Evidence of what pest?
(Use all of your senses!)



See Something, Say Something Webbing



See Something, Say Something Gnawing



See Something, Say Something

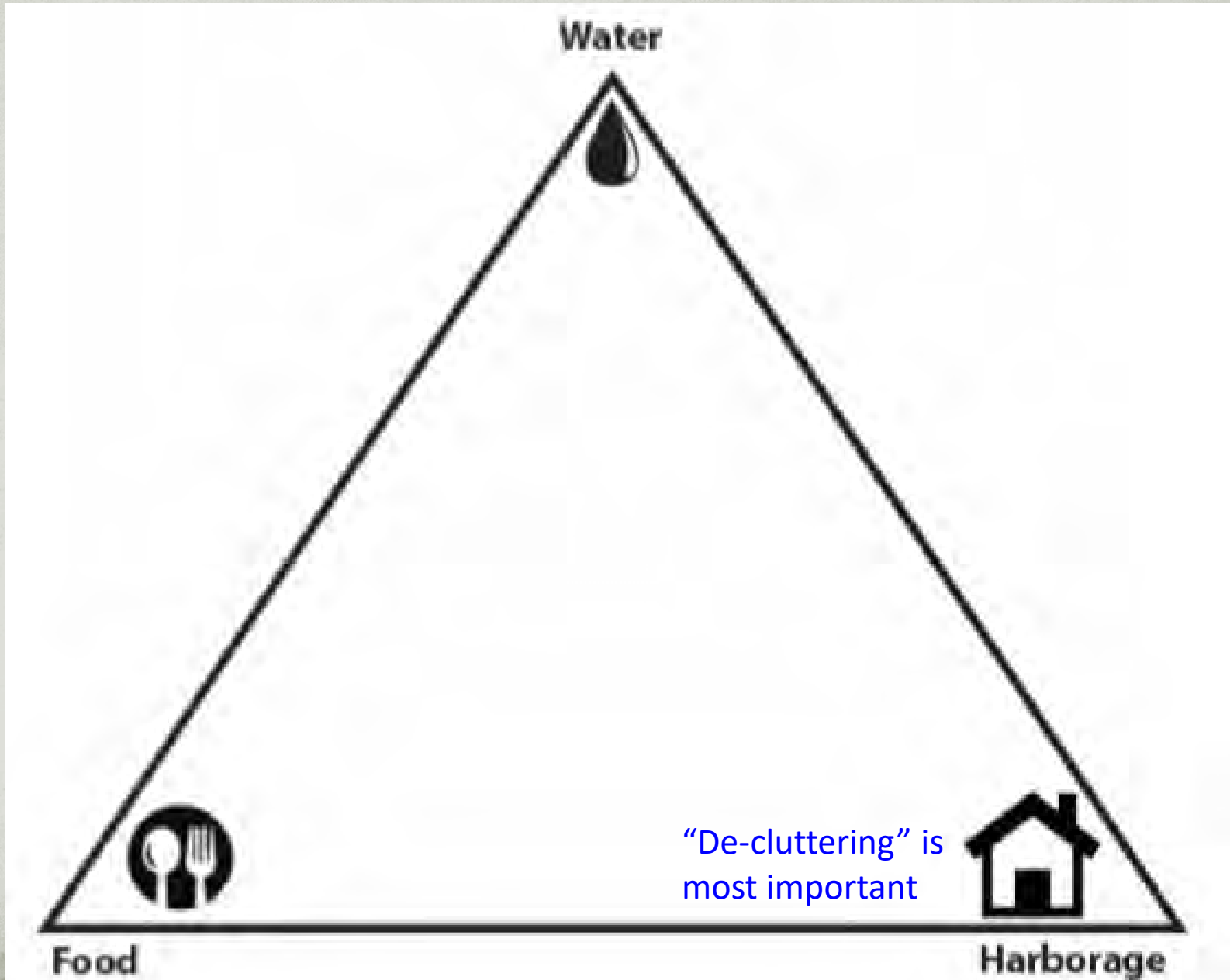
Tracks, Marks



Homeowner Objectives

- Understand pest PREVENTION
- Manage a few common household pests
- Recognize human behaviors that cause pest problems
- Know when to call a professional
 - Controlling infestations related to public health—generally rodents
 - Structurally damaging such as termites

Eliminate one or all of these factors to increase pest control success



Correct Identification is KEY

Do Not Rely on ID from Untrained People

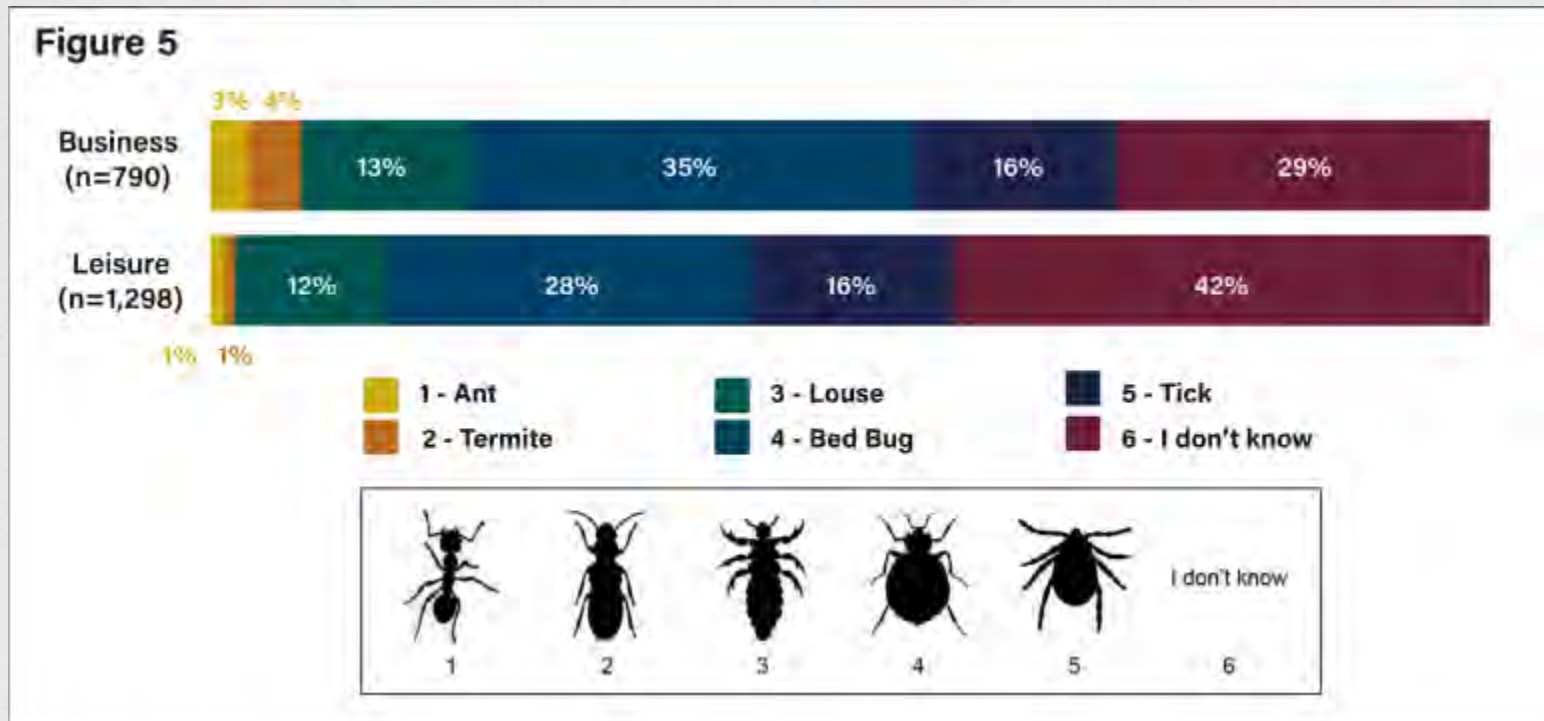


Fig. 5. The percentage of respondents (by business and leisure travelers) who identified various arthropod outlines as those of bed bugs.

Insect ID Laboratory

- <http://entnemdept.ufl.edu/insectid/>



UF UNIVERSITY of FLORIDA
IFAS

TO VIEW
an insect
slide show,
pick a category

Beneficials or Natural Enemies

Biting and Stinging Pests

"Bug Babies"

Common Florida Insects

Exotic or Introduced Species

Food and Fabric Pests

Fruit Pests: Citrus

Noninsects that Have More Than Six Legs

Snails, Slugs and "Worms"

Occasional Invaders

Pests of Ornamental Shrubs and

Lyle Buss
Insect ID Lab Manager

**Welcome to the Insect ID Lab
at the University of Florida**

Need to name that bug?

A host of experts is available to help Floridians identify any insect or related arthropod. If your mystery creature has six or more legs, the UF Insect ID Lab is the place to send it.

In most cases when you send a specimen to the Insect ID Lab, manager Lyle Buss will review it, identify it and respond with the result. If it is an unusual specimen, Mr. Buss forwards it to a commodity or taxonomic specialist within the UF/IFAS Extension System or the Florida Department of Agriculture, Division of Plant Industry. Mr. Buss will send you the final identification results. [Read instructions and complete the form to begin the process.](#)

About the Insect ID Lab and its partners

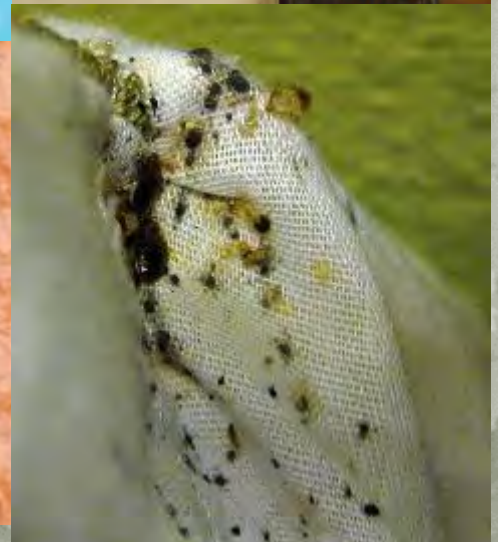
What Are the Most Common Complaints?

Indoors

- Ants
- (i.e., Pharaoh)

- German Cockroaches

- Bed Bugs



How Do German Cockroaches Become a Problem?



- We bring them in
- And feed them
- And provide an undisturbed place to reproduce



Cockroaches are “Cryptobiotic”

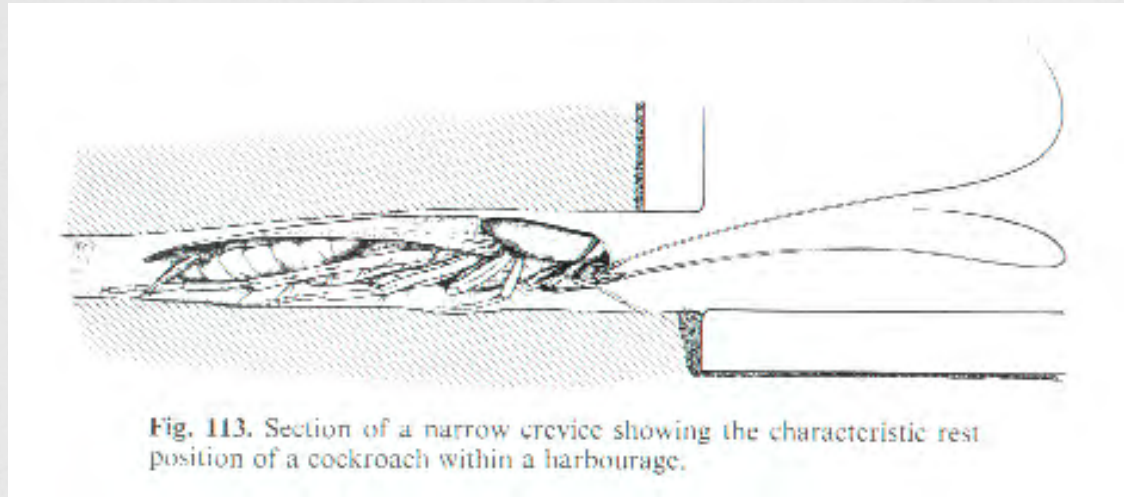
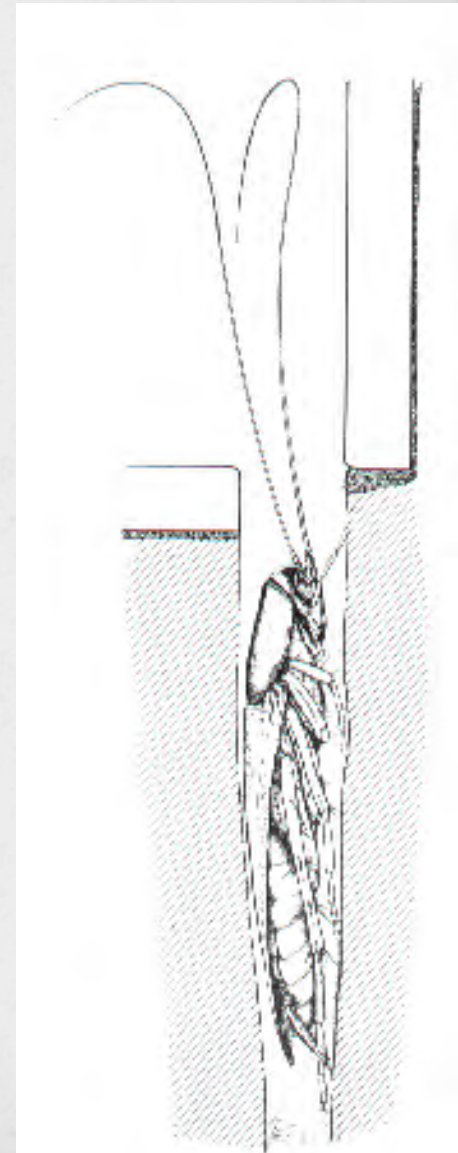


Fig. 113. Section of a narrow crevice showing the characteristic rest position of a cockroach within a harbourage.

- 67% of cockroaches gathered in 4.8 mm space
 - Horizontal placards
- 85% of cockroaches
 - Vertical placards
- (Wille 1920)





Given their preference to be cryptobiotic, what can it mean when cockroaches are seen in the open during the day?

Fecal spotting and pellets are **EVIDENCE** of cockroaches. There is also a distinctive cockroach odor. Use all of your senses!

What does this monitor tell you? What types of cockroach do you see? Suggested control? When to call a professional.



German cockroach females carry their ootheca until close to hatch which is different than peridomestic cockroaches

- What's the advantage?
 - Survival
 - Also facilitates movement and spread of population within structure
- Monitoring can help you track movement



Monitors can catch introductions.

Want to find one German cockroach or the infestation below?

How many German cockroach oothecae?
How many nymphs? Do the math...

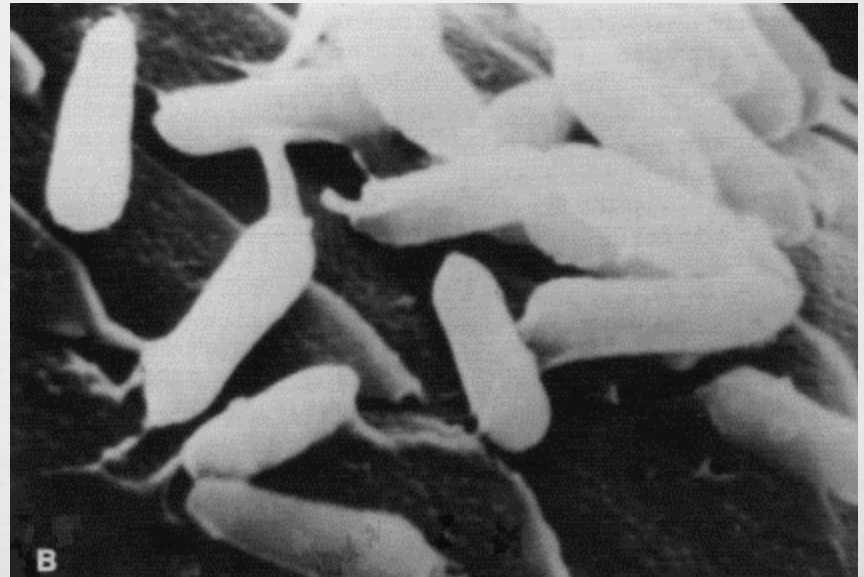
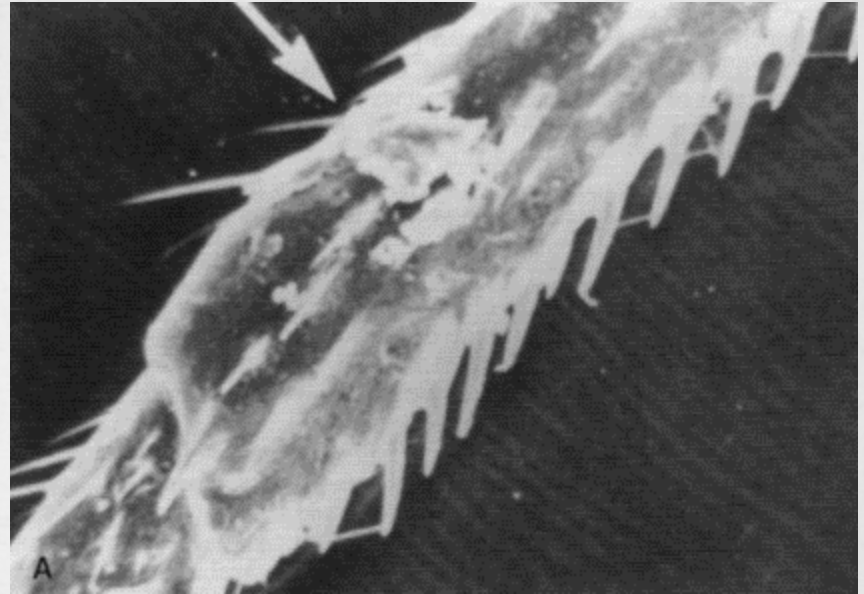


Photo: R. Bernal

- German cockroach
 - 40 eggs per ootheca
 - About 1 ootheca per month
 - 8 oothecae in her lifetime
 - ~320 offspring
- American cockroach
 - 12 eggs per ootheca
 - About one ootheca per 5 days
 - 30 oothecae in her lifetime
 - ~360 offspring
 - (Schal, 2011. Mallis)

Why We Don't Want Cockroaches in Our Kitchens

More important:
Allergens and
asthma



Why Pest Control Matters

Focusing on German Cockroaches

- Research team baited everywhere they found cockroaches in monitors (which was different than the usual pest control practice)
- They found that cockroach control alone can significantly reduce allergen levels to below the threshold for asthma



Environmental and occupational disorders

Abatement of cockroach allergen (Bla g 1) in low-income, urban housing: A randomized controlled trial

Samuel J. Arbes, Jr, PhD,^a Michelle Sever, BS,^a Janet Archer, MSc,^b Elizabeth H. Long, BSN,^b J. Chad Gore, MS,^c Coby Schal, PhD,^c Michelle Walter, MS,^d Betsy Nuebler, BA,^d Ben Vaughn, MS,^d Herman Mitchell, PhD,^d Eric Liu, BS,^a Nicholas Collette, BS,^a Peter Adler, BS,^a Megan Sandel, MD,^a and Darryl C. Zeldin, MD^a *Research Triangle Park, Durham, Raleigh, and Chapel Hill, NC, and Boston, Mass*

Why Pest Control Matters, Part II

The Case for IPM and Monitoring

Environmental and occupational respiratory disorders

Cockroach allergen reduction by cockroach control alone in low-income urban homes: A randomized control trial

Michelle L. Sever, BS,^a Samuel J. Arbes, Jr, PhD,^a J. Chad Gore, PhD,^b Richard G. Santangelo, BS,^b Ben Vaughn, MS,^c Herman Mitchell, PhD,^c Coby Schal, PhD,^b and Darryl C. Zeldin, MD^a *Research Triangle Park, Raleigh, and Chapel Hill, NC*

- Objective: Compare effectiveness of professional entomologists versus commercial companies
- Methods: Entomologists **baited where monitors indicated cockroach activity**; companies (4 were selected for study) used sprays, dusts to baseboards and cracks and crevices with some baits on a calendar basis (monthly, bimonthly, quarterly).

Why Pest Control Matters, Part II

Costs

	Cost over 12 months	Comments
Entomologist-treated	\$281	\$80, median cost of bait placement \$201, cost of traps, labor to place and retrieve, labor to count
PMP-treated	\$475	Median cost of 12-month contract per home

Other considerations: Because PC companies were spraying and dusting, label directions also required residents to prepare by cleaning out cabinets and drawers, so there was less compliance, which probably contributed to fewer units with complete control.

EDIS, ENY989

Assessment-Based Pest Management of German Cockroaches¹

F.M. Oi, E. Weeks, J. Jonovich, and D. Miller²

Integrated pest management (IPM) has been misunderstood and consequently has suffered from poor adoption, even though the concept has demonstrated success. We use the term “assessment-based” pest management (APM), coined by D. Miller, to emphasize the importance of evaluating the intensity of the pest problem and concomitant conducive conditions before treatment is attempted

- German cockroaches are among the most prolific cockroach species, producing 3 to 6 generations per year.
 - One ootheca (egg case) contains between 30 to 40 nymphs. Thus, one gravid female is cause for pest control intervention.
- In her lifetime, a female may produce:

This publication contains a lot of information to use as a reference.

What Are the Most Common Complaints?

Indoors

- Ants
- (i.e., Pharaoh)

- German
Cockroaches

- Bed Bugs



- Never proven conclusively in human transmission, “naturally.”

- They have been found to carry 25 different disease organisms—and now MRSA

- Plague
- Relapsing fever
- Tularemia
- Q Fever

Correspondence

Colonization of *Cimex lectularius* with Methicillin-resistant *Staphylococcus aureus*

Alexis M. Barbarin,^{1*} Baofeng Hu,² Irving Nachamkin¹ and Michael Z. Levy^{1**}
 Departments of ¹BioStatistics & Epidemiology and ²Pathology and Laboratory Medicine and Center for Clinical Epidemiology and Biostatistics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA.

Summary

A recent paper published by Lowe and Romney in *Emerging Infectious Diseases* titled, *Bed bugs as Vectors for Drug-Resistant Bacteria* has sparked a renewed interest in bed bug vector potential. We followed a pyrethroid resistant strain of the human bed bug (*Cimex lectularius*, L.) fed either human blood or human blood with added methicillin resistant *Staphylococcus aureus* (MRSA) for 9 days post-feeding. Results indicated that while the bed bug midgut is a hospitable environment for MRSA, the bacteria does not survive longer than 9 days within the midgut. Additionally, MRSA is not amplified within the midgut of the bug as the infection was cleared within 9 days. Due to the weekly feeding behaviours of bed bugs, these results suggest that bed bug transmission of MRSA is highly unlikely.

Cimex lectularius, the common bed bug, has made a global resurgence over the past two decades. After being nearly eradicated in the 1950s due to the widespread use of carbamates, organophosphates and dichlorodiphenyltrichloroethane (DDT), regulatory restrictions on these insecticides have spurred the concurrent return of these pests in Australia, Europe and the Americas since the late 1990s (Davies et al., 2012). As bed bug infestations continue to rise worldwide, so does fear that they may carry pathogens. To date, no report has demon-

strated conclusively that they are in fact an infectious disease vector. Prior to the mid-1990s, MRSA infections were confined to health-care facilities, hospitals and their patients. Since then, the number of Methicillin-resistant *Staphylococcus aureus* (MRSA) infections in populations with no exposure to health-care systems has risen exponentially (David and Daum, 2010). This increase has been closely linked to the recognition of new MRSA strains, often termed community-associated MRSA (CA-MRSA) strain (David and Daum, 2010).

A recent report published in *Emerging Infectious Diseases* suggests bed bugs could be vectors of MRSA (Lowe and Romney, 2011). The report could not discern whether the bed bugs were harbouring the bacteria internally, or simply carrying it on their cuticle. We therefore performed an experiment to determine whether bed bugs are able to harbour MRSA in their midgut, and if so for how long.

The study

Bed bugs used in this study were derived from the EQL-05 field colony collected from six commercial properties located in Florida, Minnesota, New Jersey and Wisconsin in 2005 (Olson et al., 2009). Adult bed bugs of both sexes were randomly selected from the main colony and placed into control or treatment groups ($n = 40$). Both groups were starved for ~14 days prior to experimentation. The control group was fed 18 ml whole human blood mixed (obtained from Division of Transfusion Medicine at our institution) with 180 μ l saline solution using an artificial feeder (Montes et al., 2002). The treatment group was fed 18 ml whole human blood containing 180 μ l saline solution containing a 10^7 CFU ml⁻¹ concentration of Methicillin-resistant *S. aureus* (ATCC 43300). Both groups were allowed to feed for 12 h to ensure adequate access to blood. Five bed bugs of each treatment were dissected at day one, three, five, seven and nine post blood feeding. Gut contents were directly plated onto CHROMagar MRSA (Becton Dickinson, Sparks, Maryland, USA) plates. Sample inoculated plates were then incubated at 37°C for 48 h. Following incubation, colony growth was scored using the semi-quantitative +1 to -4

Received 4 October 2013; accepted 31 December 2013. For correspondence: *E-mail: ambarbar@pennmedicine.upenn.edu; Tel: (1) 919 315 1820; Fax: (1) 919 315 7746; **E-mail: mlevy@mal.med.upenn.edu; Tel: (1) 215 746 8131; Fax: (1) 215 746 6502.

“Histamine levels in bed bug infested homes were at least 20 times higher than histamine levels in homes without bed bugs...” (DeVries)

Research and Innovation

Bed Bug Histamines Are Substantial, Persistent in Infested Homes

February 12, 2018 | [Mick Kulikowski](#)



- Histamines released as part of immune response.
- Cause inflammation but also help in fighting pathogens and other cellular report work.
- “Histamines are used in skin and respiratory allergy tests as a positive control – they cause a bump in skin tests and restrict breathing in respiratory tests...”

Detroit Man Trying To Kill Bed Bugs Sets Self, Apartment Building On Fire

January 9, 2016 1:35 PM

Filed Under: Apartment Fire, bedbugs, detroit, detroit fire

January 9, 2016



(credit istock)

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CLICK DEALS

Prosecutor: Son, upset about bedbugs, killed elderly mother

BREAKING NEWS
Death toll from cyclone in Pacific nation of Vanuatu has risen to 24, U.N. agency says.

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News Video TV Opinions More...
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Infant dies after mom's bed bug pesticide treatment

Source: [Associated Press](#)
Added on: 11:00 AM PT, Wed February 11, 2015



MINNEAPOLIS — Prosecutors say a Minneapolis man admitted that he killed his 89-year-old mother because he was upset that a bedbug outbreak would get her kicked out of her home.

Michael Gallagher is charged with second-degree murder in the death of Patricia Ann Gallagher. The 62-year-old's bail was set at \$2 million Tuesday.

The St. Paul Pioneer Press reports that Gallagher told investigators that he went to his mother's downtown Minneapolis apartment on Thursday to help her clean and that he called 911 the next morning and said he had killed her.

Police say Gallagher said he beat his mother with a sculpture of him with a pillow and lawyer yet.

Dec 21, 2015

by Associated Press Prosecutors Minneapolis man admitted that he killed her because he was upset that a bedbug outbreak would get her kicked out of her home. Gallagher is charged with second-degree murder in the death of Patricia Ann...

JUDICIARY

Bedbugs spotted on lawyer's jacket lead to courthouse closure

BY DEBRA CASSENS WEISS

Feb 2019

POSTED FEBRUARY 6, 2019, 11:50 AM CST

Like 704 Share Tweet Share



Image from Shutterstock.

A courthouse in Claremore, Oklahoma, was evacuated and closed Monday after bedbugs were discovered on a lawyer's jacket.

Rogers County Sheriff Scott Walton gave the details to the [Tulsa World and News](#) on 6.

Someone noticed something crawling on the neck of a lawyer in a third-floor courtroom during a morning docket call, Walton said. The lawyer "laid his coat over some files. When his coat was moved, bedbugs fell out of it," Walton told the [Tulsa World](#).

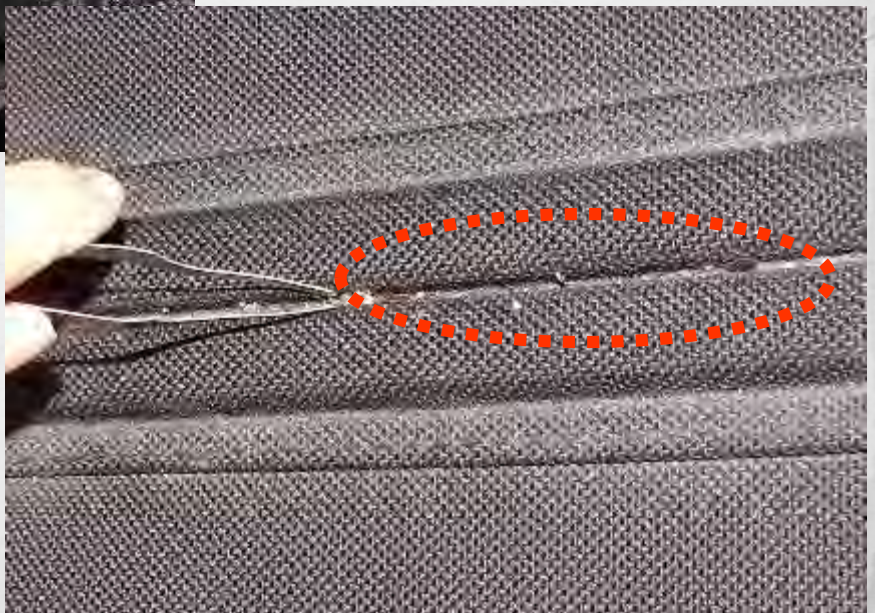
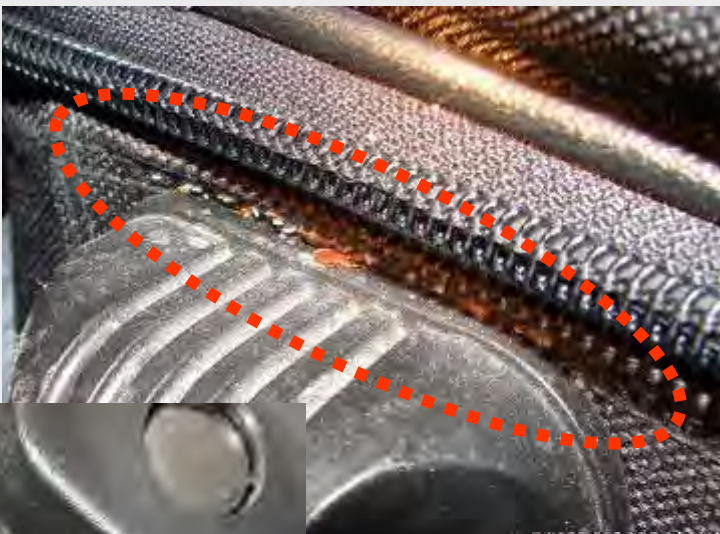
The lawyer, who was not identified, visits the courthouse about once per month, Walton said.

The courthouse reopened Tuesday morning, according to the [Tulsa World](#) and [Fox 23](#). Powder and spray were used to kill any insects.

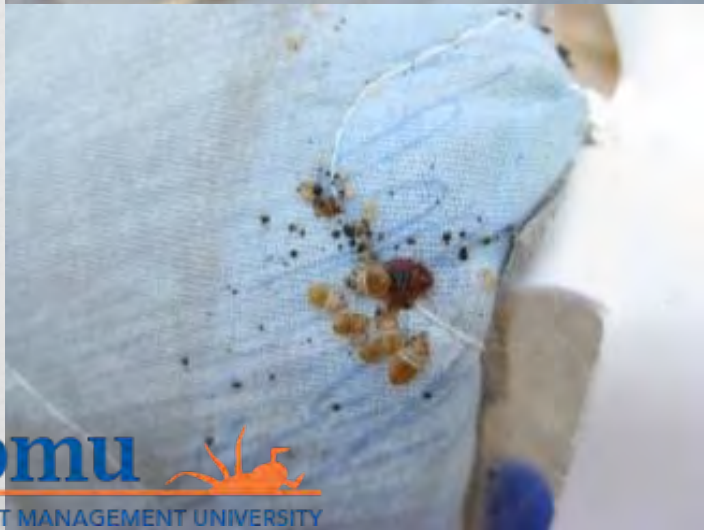
A county commissioner, Steve Hendrix, told the [Tulsa World](#) the presence of bedbugs was not actually confirmed. But the courthouse was closed to allow for treatment of possible contamination.

How do bed bugs get into my home?

We transport them!
Figuring out how BB got into a home is helpful in devising plan.



Understand that not everyone can afford pest control at home





The Key to Bed Bug Management

- INTRODUCTION vs. INFESTATION
- VIGILANCE
- SIMPLIFY
- A clothes dryer and vacuum are a essential



How many bed bugs can you eliminate by vacuuming?

More than you can by NOT vacuuming!



Inspection, Detection, Sanitation Easier to Inspect this?



Inspection, Detection, Sanitation Or this?





Photo: J Nettles



Photo: J Nettles

Encasements Work Excellent Information at Bed Bug Central



© Bed Bug Central

<https://www.bedbugcentral.com/bedbugs101/mattress-and-box-spring-encasements>

Also Helpful



Also Helpful





Bed bugs evolved unique adaptive strategy to resist pyrethroid insecticides

SUBJECT AREAS:

ENTOMOLOGY

MOLECULAR BIOLOGY

GENOMICS

Fang Zhu, Hemant Gujar, Jennifer R. Gordon, Kenneth F. Haynes, Michael F. Potter & Subba R. Palli

Department of Entomology, College of Agriculture, University of Kentucky, Lexington, KY 40546, USA.

Mechanism

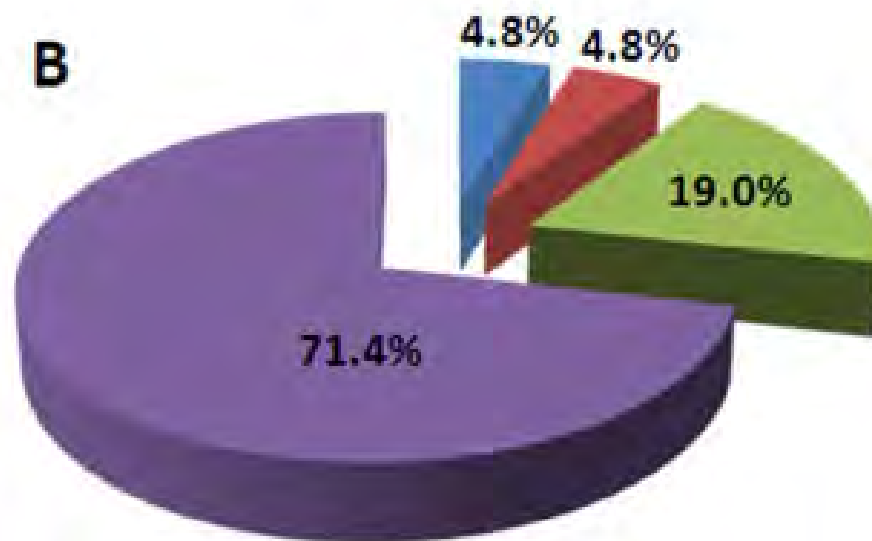
0

2

3

4

5



■ Two mechanisms

■ Three mechanisms

■ Four mechanisms

■ Five mechanisms

1. Cuticular penetration
2. Excreted as accelerated rate
3. Metabolic detoxification
4. Target site mutations (target site insensitivity)
5. Behavioral

Ineffective—Ultrasonic Devices

HOUSEHOLD AND STRUCTURAL 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 Pine Knoll Drive, Flagstaff, AZ 86011

J. Econ. Entomol. 105(6): 2107–2114 (2012); DOI: <http://dx.doi.org/10.1111/j.1365-3113.2012.04512.x>; ECI2166

ABSTRACT Little is known about the potential for acoustic communication in bed bugs, *Cimex lectularius* L. (Hemiptera: Cimicidae), or the use of sound as cues in most locations, although many hemipterans are known to communicate with sound. Most behavioral research has focused on bed bug pheromones that are used in aggregation and as alarm signals. We investigated the influence of sound as a deterrent and as an attractant, either of which could ultimately be used to monitor and control bed bugs. Female bed bugs were tested in choice tests with four different commercially available ultrasonic repellent devices. We found that female bed bugs were equally likely to occur in arenas with or without sound produced by ultrasonic devices. These devices did not repel or attract bed bugs during choice trials. However, more bed bugs preferred the middle corridor between the test (sound) and control (no sound) arenas when the sound devices were played. Bed bugs were also more likely to exit the middle corridor during control trials compared with treatment trials with ultrasonic devices. Our results confirm that commercial devices producing ultrasound are not a promising tool for repelling bed bugs.

KEY WORDS bed bug, ultrasound, management, repellency, *Cimex lectularius*

Foggers are Ineffective Against Bed Bugs AND Cockroaches

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/10.1093/EC12037>

ABSTRACT Field-collected bed bugs (*Cimex lectularius* L.) showed little, if any, adverse effects after 2-h direct exposure to the aerosolized pyrethroids from three over-the-counter total-release foggers ('bug bombs' or 'foggers'); Hotshot Bedbug Fogger, 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 27% 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 would not be directly contacted by the insecticide mist from foggers. This study provides the first 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, and they are not affected by brief exposure to low concentrations of pyrethrins and/or pyrethroids provided by foggers; and 2) there is minimal, if any, insecticide penetration into typical bed bug harborage sites. 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 agents.

KEY WORDS bug bomb, *Cimex lectularius*, fogger, pyrethroid, resistance

What doesn't work

Potential of Essential Oil-Based Pesticides and Detergents for Bed Bug Control

NARINDERPAL SINGH, CHANGLU WANG,¹ AND RICHARD COOPER

Department of Entomology, Rutgers University, 93 Lipman Drive, New Brunswick, NJ 08901

J. Econ. Entomol. 107(6): 2163–2170 (2014); DOI: <http://dx.doi.org/10.1603/EC14328>

ABSTRACT The bed bug, (*Cimex lectularius* L.), is a difficult pest to control. Prevalence of insecticide resistance among bed bug populations and concerns over human pesticide exposure has stimulated the development of alternative bed bug control materials. Many essential oil-based pesticides and detergent insecticides targeting bed bugs have been developed in recent years. We evaluated the efficacy of nine essential oil-based products and two detergents using direct spray and residual contact bioassays in the laboratory. Two conventional insecticides, Temprid SC (imidacloprid and β -cyfluthrin) and Demand CS (λ -cyhalothrin) were used for comparison. Among the 11 non-synthetic insecticides tested, only EcoRaider (1% geraniol, 1% cedar extract, and 2% sodium lauryl sulfate) and Bed Bug Patrol (0.6% clove oil, 1% peppermint oil, and 1.3% sodium lauryl sulfate) caused >90% mortality of nymphs in direct spray and forced exposure residual assays. However, the efficacy of EcoRaider and Bed Bug Patrol was significantly lower than that of Temprid SC and Demand CS in choice exposure residual bioassay. Direct spray of EcoRaider caused 87% egg mortality, whereas the other nonsynthetic insecticides had little effect on bed bug eggs. EcoRaider and Bed Bug Patrol did not exhibit detectable repellency against bed bugs in the presence of a carbon dioxide source. These findings suggest that EcoRaider and Bed Bug Patrol are potentially useful pesticides for controlling bed bug infestations, but further testing in naturally infested environments is needed.

IPM is Effective

Research Article

Received: 5 May 2014

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Accepted (in its published form): 3 January 2015

Published online in Wiley Online Library: 20 January 2015

(wileyonlinelibrary.com) DOI 10.1002/ps.3982

Evaluation of a model community-wide bed bug management program in affordable housing

Richard A Cooper, Changlu Wang* and Narinderpal Singh

Abstract

BACKGROUND: Low-income apartment communities in the United States are suffering from disproportionately high bed bug, *Cimex lectularius* L., infestations owing to lack of effective monitoring and treatment. Studies examining the effectiveness of integrated pest management (IPM) for the control of bed bugs in affordable housing have been limited to small subsets of bed-bug-infested apartments, rather than at the apartment community level. We developed, implemented and evaluated a complex-wide IPM program for bed bugs in an affordable housing community. Proactive inspections and biweekly treatments using a combination of non-chemical and chemical methods until bed bugs were not detected for three biweekly monitoring visits were key elements of the IPM program.

RESULTS: A total of 55 bed-bug-infested apartments were identified during the initial inspection. Property management was unaware of 71% of these infestations. Over the next 12 months, 14 additional infested apartments were identified. The IPM program resulted in a 98% reduction in bed bug counts among treated apartments and reduced infestation rates from 15 to 2.2% after 12 months.

CONCLUSIONS: Adopting a complex-wide bed bug IPM program, incorporating proactive monitoring, and biweekly treatments of infested apartments utilizing non-chemical and chemical methods can successfully reduce infestation rates to very low levels. © 2015 Society of Chemical Industry

Keywords: *Cimex lectularius*; multifamily housing; IPM; pest control

- Jersey City Housing Authority: 358 apts
- 55 infested
- 14 more infested over 12 months
- Management unaware of 71% of infestations
- 98% reduction in BB counts after IPM program
- 15% of apts infested to 2.2% after 12 months.
- Encasements, vacuum, steam
- MotherEarth® D, Phantom®
- Cost: \$50/hr (labor)

Pest control company tasked with killing bedbugs takes the life of 82-year-old woman: lawsuit



- Chemical exposure has been a concern in bed bug litigation, until this lawsuit
- Heat is popular because of insecticide resistance



CASE REPORT

PATHOLOGY/BIOLOGY

Michelle R. Sanford,¹ Ph.D.; Mirna Torres,¹ B.A.; and Jennifer Ross,¹ M.D.

Unexpected Human Fatality Associated with Bed Bug (Hemiptera: Cimicidae) Heat Treatment*

“...had **medical conditions** and was taking medications that **may have reduced her ability to dissipate heat**, the air conditioning inside the apartment appeared to have failed, and the decedent and her spouse did not appear to be aware of the symptoms and danger of heat stroke

Author recommendations: Set a re-entry temperature of 26°C/78.8°F; **clear communication** of re-entry time.

When to call a professional

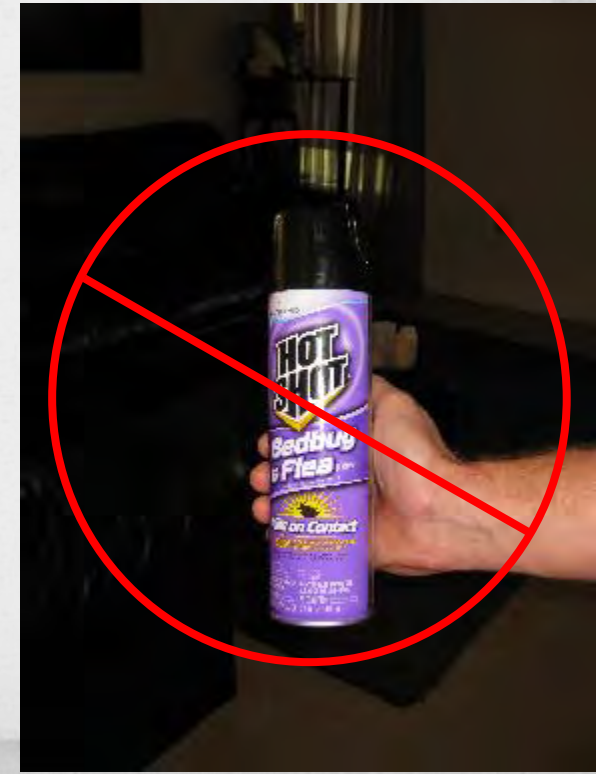




Bed Bug Action Plan for Home Health Care and Social Workers

Dini M. Miller, Ph.D., Department of Entomology, Virginia Tech
Stephen Kells Ph. D. Department of Entomology, University of Minnesota

- Most comprehensive set of BB fact sheets:
 - Google “VDACS Bed Bugs”
 - <https://www.vdacs.virginia.gov/pesticide-bedbug-fact-sheets.shtml>
 - Foggers are ineffective.



What Are the Most Common Complaints?

Indoors

- Fleas



- Ticks



- Pantry Pests



- Fabric Pests



Ticks are Major Vectors of Disease Causing Organisms

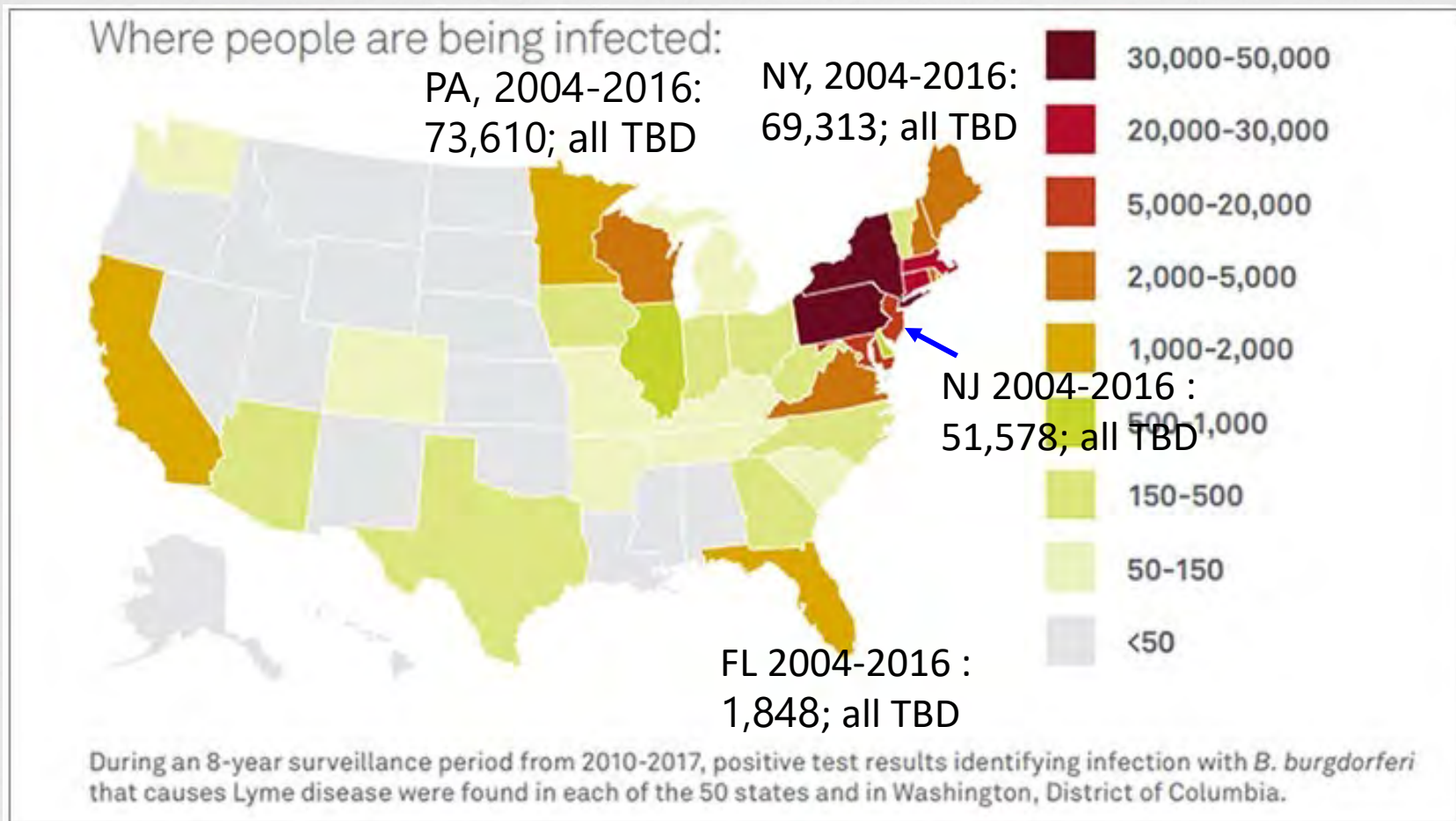
- Anaplasmosis
- Babesiosis
- *Borrelia miyamotoi*
- Colorado tick fever
- Ehrlichiosis
- Heartland virus
- **Lyme disease**
 - *B. burgdorferi*
- Powassan disease

- *Rickettsia parkeri*
rickettsiosis
- **Rocky Mountain spotted fever**



- Southern tick-associated rash illness (STARI)
- Tickborne relapsing fever
- Tularemia
- 362D rickettsiosis

Lyme disease now has been recorded from all 50 states (N=6M samples)



NE +49.6%, Lyme
2015: 7,718
2017: 11,549

PA +78.0%, Lyme
2015: 5,619
2017: 10,001

https://questdiagnostics.com/dms/Documents/health-trends/Quest_LymeDiseaseTrendsReport_2018.pdf

Ticks



- Newest tick of concern
 - *Haemaphysalis longicornis* (a.k.a. “longhorn ticks,” bush or cattle tick) first found in Hunterdon County, NJ, now found in VA, WV, AR, and **NC** and seems to be spreading.
 - Parthenogenetic
 - Can transmit disease-causing pathogens to cattle
 - Humans-- Severe fever with Thrombocytopenia Syndrome Virus (Zhuang et al. 2018)
 - **Fatality rate: 10 to 30%**

Wide host range

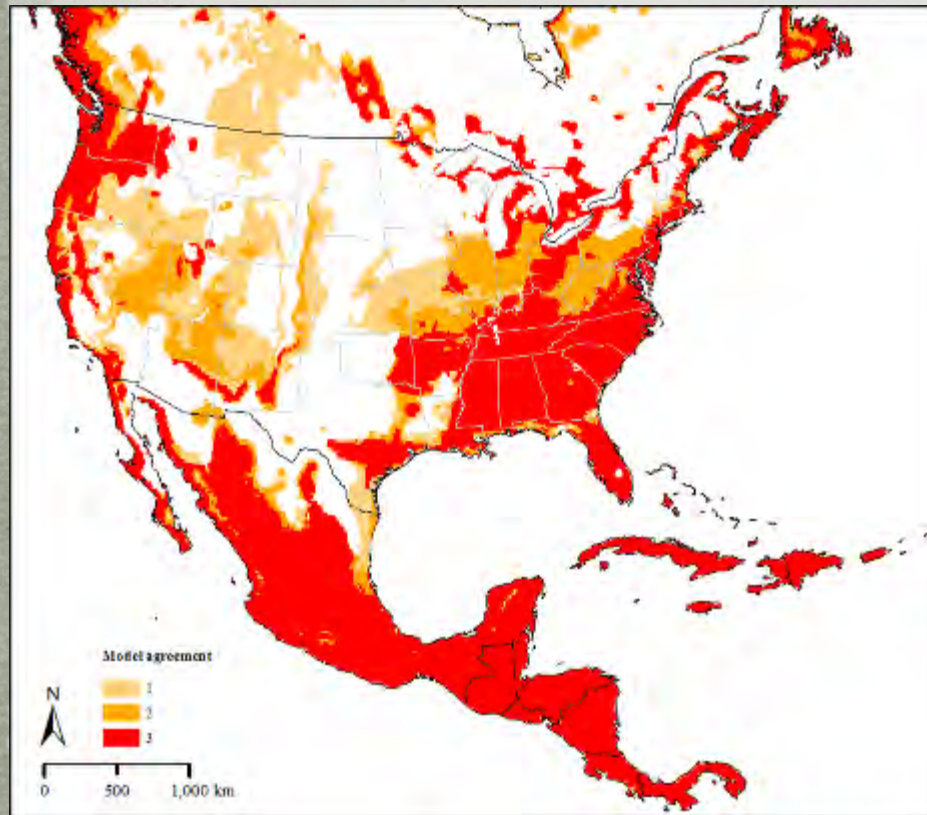
- In the United States, hosts to date have included: **dog**, cow, goat, sheep, horse, white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis virginiana*), and raccoon (*Procyon lotor*).
- Additionally, in both invasive and native populations outside the United States, previous reports describe *H. longicornis* **parasitizing humans**.

*All models are wrong
but some are useful*



George E.P. Box

Potential Spatial Distribution of the Newly Introduced Long-horned Tick, *Haemaphysalis longicornis* in North America



- “Predicted suitable areas for *Haemaphysalis longicornis* across North America. 1, 2, and 3 represent areas that were predicted to be suitable for the establishment of *H. longicornis* in North America by one, two and three models, respectively. Darker areas represent progressively higher agreement between the models.”

A 12-year-old Icelandic sheep living on a property in Hunterdon County, New Jersey, was found in 2017 to be infested with numerous ticks of the species *Haemaphysalis longicornis* (shown above in a closeup of the sheep's ear). Further investigation found a large infestation of *H. longicornis*, in multiple life stages, on the property. The tick species is [native to Asia](#), and the appearance in [New Jersey](#) marks the first potentially established population of the species ever documented in the United States. (Image originally published in Rainey et al 2018, Journal of Medical Entomology)



“...there are no approved insecticides for the Longhorn tick in the U.S...” (Use labels for site.)



“VDACS confirms Longhorned tick detected in Virginia”
(June 2019)

Can you spot the five ticks in the muffin? The CDC caused a panic when it tweeted that ticks can be as small as a poppyseed. CDC



Reference with Guidance on Tick Removal

- EDIS EENY-443: American Dog Tick, *Dermacentor variabilis* (Say) (Arachnida: Ixodida: Ixodidae) (<https://edis.ifas.ufl.edu/in781>)

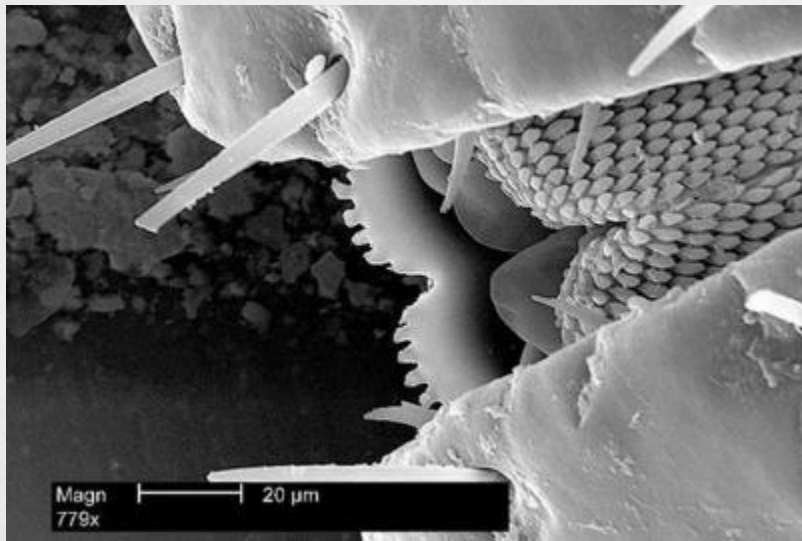


Figure 9. Enlarged view of the mouthparts of an American dog tick, *Dermacentor variabilis* (Say). Notice the hundreds of sharp, backward-directed barbs which assist the tick in holding onto its host. For an even closer look at these barbs see figure 10.

Sanitation is IPM



Medieval Diseases Are Mounting A Comeback, Specialists Say. What Are The Causes?

April 03, 2019 By Robin Young and Jack Mitchell



Typhoid Fever, Typhus & Tuberculosis: Are L.A.'s Medieval Diseases Coming To Your City?



Chuck DeVore Contributor @ Policy
Texas Public Policy Foundation VP and former California legislator



Integrated Pest Management is Problem Solving

- All of the common indoor and outdoor pests can be PREVENTED by using Integrated pest management (IPM)
- Existing pest problems can be solved using IPM
- Integrated pest management is not just the application of pesticides or absence of pesticides

Integrated Pest Management is Problem Solving

- It is a process designed to:
 - **Stop pests**
 - **Inspect and monitor for pests**
 - **Identify pests**
 - **Have a game plan to protect your house**
 - **Know if your plan is working**

What are the **Tactics** in a Management Strategy?

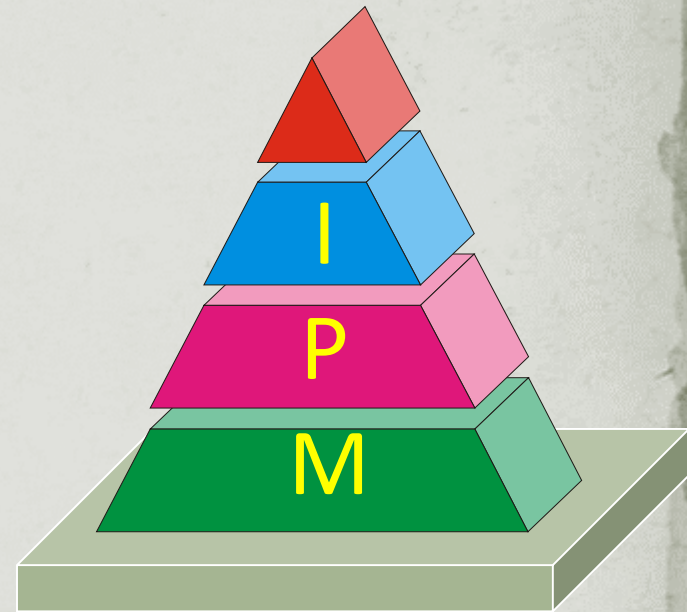
Pesticides

Biological Control

Physical and Mechanical Control

Cultural and Sanitation Practices

Education and Communication



IPM (Integrated Pest Management) – an integration of technologies used to reduce pests and pest conducive conditions. *Common sense pest control.*

Exclusion is Major Component of PREVENTION in IPM

- Exclusion prevents outdoor pests from entering
- And yet, according to a recent survey
 - Only ~35% of pest control companies offer exclusion
 - 32% said that not all technicians are trained to do exclusion
 - 15% said it takes too much time



Aug 20, 2018,
<http://www.pctonline.com/article/exclusion-future-pest-management/>

Homeowners Are Ideally Suited

- ...to implement the most important step of pest prevention for your own homes
- Exclusion involves home maintenance
 - Most pest control companies will not do exclusion and sanitation, which are the most important components of pest prevention
- You are often the most motivated to find a solution



What Homeowners Can Do to Prevent Pests

- Inspect incoming goods or items before bringing them into your home
- German cockroaches often enter homes via cardboard boxes and paper bags?
 - One German cockroach egg case (ootheca) can contain between 30-40 eggs
- One female bed bug can produce an average of 200 eggs in her life-time

Sealing the Building Envelope Will Keep Outdoor Pests Outside!



Doors and windows are part of the building envelope

IPM =

Integrated People Management