OSU Webinar 2

Treating for Bed Bugs: Integrated Pest Management (IPM) Strategies

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INTEGRATED PEST MANAGEMENT (IPM):

- Correctly identify the pest
- Conduct a thorough inspection
- Use sanitation measures
- Use non-chemical measures
- Apply insecticides to targeted sites

Webinar 1

Webinar 2
Webinar 2
Treating for Bed Bugs
What will you learn today?

- Insecticide resistance in bed bugs
- Tips for hiring a pest management professional (PMP)
- Inspection and monitoring options
- Ohio pesticide regulations
- Bed bug treatment options and general guidelines for:
  - heat treatments
  - insecticide treatments
- Bed bug products
  - Registered insecticides
  - Natural products (exempt from EPA registration)
Worldwide Resurgence of Bed Bugs Since Late 1990s

Aumenta la presencia de chinches en Barcelona
Las empresas de control de plagas descarten su desaparición han incrementado las actuaciones contra estos insectos en

SPAIN

Montréal: épidémie de punaises de lit confirmée

mardi 26 octobre 2010 à 18H38

The Times
THE SUNDAY TIMES

Archive Article
Please enjoy this article from The Times

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

Bed bugs eat into tourism

by Bernard O'Riordan in Sydney
The Guardian, Wednesday 6 April, 2004 01:47 BST

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 infected eight out of 10 backpacker hostels in Sydney's eastern suburbs alone. Many bedecked, particularly at Bondi Beach and Kings Cross, rely almost exclusively on British and Irish customers.

AUSTRALIA

THE OHIO STATE UNIVERSITY
Heat Map Showing Estimated Total Number of Bed Bug Treatments in Each County in Ohio during 2011 and 2016* (the darker the color, the more bed bug treatments)

*OSU surveys of pest management companies and individuals licensed (category 10A) to treat for bed bugs in Ohio
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
Some of the challenges due to bed bugs:

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

“The inherited ability of a strain of some organism to survive doses of a toxicant that would kill the majority of individuals in a normal population of the same species.”

World Health Organization (WHO)
Pyrethroid Resistance

• Extremely high levels of resistance to two pyrethroid insecticides (deltamethrin and λ-cyhalothrin) were detected in bed bug populations collected from human dwellings in Kentucky and Ohio.

• Resistance to pyrethroid insecticides was widespread in U.S. bed bug populations.

DDT and other synthetic insecticides with long-lasting residual were very effective in controlling bed bugs.

The voltage-gated sodium ion channel in nerve membranes is the principle active site for DDT and pyrethroids.
Some newer insecticides for use against bed bugs:

<table>
<thead>
<tr>
<th>Active Ingredient (AI) (insecticide class)</th>
<th>Product Name(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imidacloprid + β-cyfluthrin (neonicotinoid + pyrethroid)</td>
<td>Temprid® SC</td>
</tr>
<tr>
<td>Acetamiprid + bifenthrin (neonicotinoid + pyrethroid)</td>
<td>Transport® Mikron Transport® GHP</td>
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<td>CimeXa™</td>
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<td>Clothianidin + metofluthrin + PBO (neonicotinoid + pyrethroid + synergist)</td>
<td>CrossFire®</td>
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</table>
Bed bugs are developing resistance to newer insecticides...

Field collected bed bugs showed high levels of resistance to 4 neonicotinoids:
- Acetamiprid (1 of 2 AIs in Transport)
- Imidacloprid (1 of 2 AIs in Temprid)
- Thiamethoxam (1 of 2 AIs in Tandem)
- Dinotefuran (1 of 2 AIs in Alpine)

Pyrethroid-resistant populations can quickly become resistant to neonicotinoids.

Of 10 field strains, reduced susceptibility was detected in 3 strains exposed to chlorfenapyr (Phantom; a halogenated pyrrole) and 5 strains exposed to bifenthrin (Talstar; a pyrethroid).

Susceptibility to chlorfenapyr and bifenthrin seems to be correlated despite the different insecticide classes.
Treatment Options

- Insecticide treatment (dusts, liquids, aerosols)
  - Residual insecticide products are essential

- Fumigation (sulfuryl fluoride)
  - Important to include residual insecticide product(s)

- Heat treatment (whole structure, container)
  - When possible, include residual insecticide product(s)
Questions?
Eliminating a bug infestation typically is NOT a do-it-yourself (DIY) task!

• Requires in-depth knowledge of:
  • Bed bug biology and behavior
  • Inspection and monitoring devices
  • Insecticides:
    • Safety (the labelling is the law)
    • Active ingredient (AI)
    • Formulations (dusts esp. important for bed bugs)
  • Building construction ....

• Requires the proper:
  • Procedures
  • Products
  • Equipment
  • Follow-up ...
Ohio Revised Code (ORC) 921.24(A): No person shall apply, use, directly supervise such application or use, or recommend a pesticide for use inconsistent with the pesticide’s labeling.

http://codes.ohio.gov/orc/5321

For information on pesticides and pesticide safety, here’s another really useful OSU website: https://pested.osu.edu/
Pesticide Misuse By Apt. Residents

Columbus, OH  4/26/11

Columbus, OH  6/28/12
BE AWARE:
Boric acid products don’t work against bed bugs!

- Boric acid does not kill bed bugs.
- Boric acid is a stomach poison that must be eaten by an insect.

Remember that bed bugs feed only on blood.
Efficacy of Diatomaceous Earth Against Bed Bugs

- Water dramatically reduces efficacy of DE, even once it dries!
- Do not allow DE applications to become damp!

OSU Research Study
BE AWARE:

Grocery store insect sprays won’t eliminate a bed bug infestation!

- Must be sprayed directly on the bed bugs (‘kills on contact’)
- Most bugs are hiding and WILL NOT be killed
- Little or no residual activity (the chemical breaks down quickly)
Contact a professional pest control company to treat for bed bugs

- ODA web site lists licensed pest mgt. companies and applicators

**Ohio Department of Agriculture Pesticide & Fertilizer Regulation Section**

614-728-6987; 800-282-1955

http://www.agri.ohio.gov
Questions to Ask a Pest Management Company When Considering Them for Bed Bug Work:

- Local, regional, or national Pest Management Association member?
- How long in business?
- Bed bug experience?
- What types of treatments? What chemicals? Cost estimate? How many treatments are expected for my bed bug problem?
- What sort of service agreement is offered?
- You can ask to see:
  - ODA Business and Custom Applicator’s License
  - Certificate of insurance
  - Workers’ compensation certificate
  - Material Safety Data Sheets (MSDS) and specimen labels
Tips for Choosing a Pest Management Company

• Obtain at least 3 competitive bids
• For each co. being considered, check for satisfied customer references that relate to bed bug control:
  • Chamber of Commerce
  • Better Business Bureau
  • Angie’s List or similar
• [https://ohioline.osu.edu/factsheet/HYG-2178-11](https://ohioline.osu.edu/factsheet/HYG-2178-11) for more detailed info
Questions?
In Ohio, when are Pesticide Applicators Required to be Licensed?

• Pesticide applications made for hire
• Public employees (federal, state, county, township, city, village or school district)
• When applying pesticides to publicly-accessible sites, such as:
  • Restaurants
  • Schools & daycares
  • Hospitals & medical centers
  • Parks
  • Golf courses
  • etc.
• Rental owners/employees w/ more than 4 apartments @ one location
In Ohio: Apartment/Rental Owners & Managers

Owners and employees of rental properties with more than 4 apartment units at one location are required to be licensed as Commercial Applicators in order to apply pesticides at those properties.
In Ohio, request bed bug treatment information from your PMP:

On request from a resident or customer, the pest management provider must provide a legibly written statement detailing:

– Name of each product used
– Amount of each product applied
– Date of application

The individual can then look up product information online or via other sources.
§ 5321.04
Obligations of Landlord

(A) A Landlord who is a party to a rental agreement shall do all of the following:

1. Comply with the requirements of all applicable building, housing, health, and safety codes that materially affect health and safety;

2. Make all repairs and do whatever is reasonably necessary to put and keep the premises;

3. Keep all common areas of the premises in a safe and sanitary condition.
§ 5321.05  
Obligations of Tenant

(A) A Tenant who is party to a rental agreement shall do all of the following...

1. Keep that part of the premises that he occupies and uses safe and sanitary;

5. Comply with the requirements imposed in tenants by all applicable state and local housing, health, and safety codes;...

9. (B) The Tenant shall not unreasonably withhold consent for the Landlord to enter...
4551.01 Responsibility of Owner

Responsibilities of owners and occupants include, but are not limited to, the following areas:

(f) Pest elimination. The owner is responsible for elimination of any insects, rats, or other pests in a dwelling containing two (2) or more dwelling units and on the premises thereof. He is also responsible whenever the infestation is caused by improper rat-proofing of the premises.
4551.02 Responsibility of Occupant

(f) Pest Elimination. The occupant is responsible for elimination of any insects, rats, or other pests within that part of the premises occupied and controlled by him in a single family dwelling or in a dwelling containing two (2) or more dwelling units if his unit is the only one infested unless infestation of the premises was caused by improper rat-proofing.
Bed Bugs In Public Facilities

• Brought in by visitors, staff, etc.
• Brought in on clothing, coats, shoes, bags, purses, briefcases, wheelchairs, walkers, etc.
• Often it’s one bug that then crawls into the facilities’ chairs, carpeting, equipment, etc.
• A single bed bug does not warrant panic or business closure!
Bed Bugs In Public Facilities

• *Early identification is very important*
  • Staff should be trained re. what to look for
  • Maintenance and cleaning crews should be on the lookout for telltale signs of bed bugs
• *Capture a bug for positive identification*
Bed Bugs In Public Facilities

• *If it’s a bed bug, then consider:*
  • If it’s a bed bug nymph, it’s too young to reproducing (it’s not laying eggs)
  • If it’s an adult male, he will never lay eggs
  • If it’s a very flat adult female, she’s not likely to be laying eggs
  • Mating typically occurs very soon after an adult female bed bug finishes feeding
--Passive Monitoring Devices--

**Bed Bug Interceptors**

- Positioned under furniture legs
- Furniture must be kept in use—bugs are attracted to host’s CO$_2$
- Pitfall trap—bed bugs climb in and cannot escape*
  - *Inner walls of ClimbUps must be kept lubricated with talcum powder or bugs can escape
- Eliminate alternative ways for bugs to access furniture (don’t let bugs bypass interceptors)
  - Keep furniture several inches away from walls
  - Don’t let bed linens, dust ruffle, & bedding contact the floor or walls
Sticky traps typically are not very useful for detecting bed bugs.
Questions?
The treatment approach should be tailored to the setting (e.g., public facility, single family home, multi-family housing, etc.), its occupants (e.g., pregnant women, infants, health-compromised, elderly, etc.), and the severity of the bed bug problem.
Non-chemical options are preferable in sensitive environments

- Heat treatment (whole structure, container)
- Cold (usefulness is limited)
- Sanitation measures
- Steam
Whole Room Heat Treatment

- Typically a 6-8 hour process
- Temperature: 135°F [57.2°C]
- It’s important to use temperature probes inside wall voids, furniture, etc.
- Double or more the cost of an insecticide treatment
- Offers no residual protection so useful to include an insecticide
Containerized Heat Treatment

≥120º F for several hours
Cold Treatment

Should NOT be a standalone measure for bed bugs
And ... **DIY sanitation measures can help reduce the number of bed bugs:**

- Vacuuming (heavy-duty vacuum)
- Steaming (hand-held steamer)
- Clothes dryer (dry items kept for 30 min. @ >120°F [49°C])
- Continuous freezing (small items) in chest freezer or refrigerator-freezer unit with *disabled “frost-free” setting*
  - <19°F [-7°C] for 3 weeks
  - <5°F [-15°C] for 4 days)
Here’s a VERY important DIY measure:

Remove clutter!

• Clutter offers many hiding places for bed bugs
• Clutter makes bed bugs difficult to detect
• Clutter makes bed bugs difficult to treat
Treatment Options

• Insecticide treatment (dusts, liquids, aerosols)
  • Residual insecticide products are essential

• Fumigation (sulfuryl fluoride)
  • Important to include residual insecticide product(s)

• Heat treatment (whole structure, container)
  • When possible, include residual insecticide product(s)
Some Basics of Bed Bug Management Using Insecticides

- Bed bug control typically takes several treatments (average of 2 to 3 trts)
- It is important to use several different formulations (dusts, sprays, etc.), and often, several different insecticides
OSU Survey: Visits Needed per Infestation

Clustered around average of 2-3 visits per infestation
Some Basics of Bed Bug Management Using Insecticides

- Residual insecticides are essential!!!
- Bed bug control is time-intensive and labor-intensive
- Spot treat all harborage sites
It’s very important to treat all bed bug hiding places:

- Behind Hanging Picture
- In Furniture
- On Mattress
- In Carpeting
- In Electrical Outlet
- Behind Baseboard
### Some newer insecticides for use against bed bugs:

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Number of Eggs Hatching After Being Directed Sprayed Until Wet (1-2 sec)

Insecticides Don’t Always Kill Bed Bug Eggs

Tests with field-collected bed bugs
Eggs were directly sprayed (contact); newly hatched nymphs were exposed to the resulting insecticide residues.

Results w/ a pyrethroid-resistant bed bug strain (Jersey City):

- **Bedlam** = MGK-264 (AI: sumithrin {a pyrethroid})
  - Majority of eggs hatched (84%)
  - Almost all nymphs survived (99%)
- **Demand CS** (AI=λ-cyhalothrin {a pyrethroid})
  - Majority of eggs hatched (91%)
  - **No nymphs survived**
- **Phantom SC** (AI=chlorfenapyr)
  - Majority of eggs hatched (95%)
  - Very few nymphs survived (4%)
- **Temprid SC** (imidacloprid + β-cyfluthrin)
  - Few eggs hatched (13%)
  - Some nymphs survived (38%)

A combination of insecticides is needed to treat eggs so that any nymphs that hatch will be killed.

Control (water):
- Almost all (99%) eggs hatched
- All nymphs survived
Words of caution regarding over-the-counter ‘natural products’ for bed bug control:

- Exempt from Environmental Protection Agency (EPA) registration
- EPA requires no efficacy data
- Claims often based on “satisfied customers”—be sure to ask for their research data and evaluate it carefully
- Botanical (plant based) products often have a strong odor
- Botanical products often have limited, if any, residual activity
**Rutgers Univ. Study: Natural Pesticides**

<table>
<thead>
<tr>
<th>No.</th>
<th>Product Trade Name</th>
<th>Active Ingredients</th>
<th>Mortality (≥50%) at 10 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EcoRaider</td>
<td>Geraniol (1%), Cedar Extract (1%) and Sodium Lauryl Sulfate (2%)</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>Stop Bugging Me</td>
<td>2-Phenethyl Propionate (3%), Cinnamon Oil (0.1%), Eugenol (0.5%), Geraniol (0.2%) and Sodium Lauryl Sulfate (0.5%)</td>
<td>Low mortality (&lt;50%)</td>
</tr>
<tr>
<td>3</td>
<td>Bed Bug Patrol</td>
<td>Clove Oil (0.003%), Peppermint Oil (1%) and Sodium Lauryl Sulfate (1.3%)</td>
<td>92%</td>
</tr>
<tr>
<td>4</td>
<td>Bed Bug Bully</td>
<td>Mint Oil (0.25%), Clove Oil (0.3%), Citronella Oil (0.4%) and Rosemary Oil (0.4%)</td>
<td>60%</td>
</tr>
<tr>
<td>5</td>
<td>Bed Bug Fix</td>
<td>2-Phenethyl Propionate (2%), Geraniol (1%), Cedar oil (0.3%), Eugenol (0.1%)</td>
<td>Low mortality (&lt;50%)</td>
</tr>
<tr>
<td>6</td>
<td>Rest Assured</td>
<td>2-Phenethyl Propionate (2%), Geraniol (1%), Cedar oil (0.3%), Eugenol (0.1%)</td>
<td>Low mortality (&lt;50%)</td>
</tr>
<tr>
<td>7</td>
<td>EcoEXEMPT IC2</td>
<td>Rosalina Essential Oil (1%)</td>
<td>Low mortality (&lt;50%)</td>
</tr>
<tr>
<td>8</td>
<td>Green Rest Easy</td>
<td>Sodium Lauryl Sulfate (3%), Sodium Chloride (1%), and Citric Acid (0.2%)</td>
<td>Low mortality (&lt;50%)</td>
</tr>
<tr>
<td>9</td>
<td>Essentria</td>
<td>2-Phenethyl Propionate and Peppermint Oil (1.5%)</td>
<td>Low mortality (&lt;50%)</td>
</tr>
<tr>
<td>10</td>
<td>Bed Bug 911</td>
<td>Sodium Lauryl Sulfate (3%), Sodium Chloride (1%) and Citric Acid (0.2%)</td>
<td>Low mortality (&lt;50%)</td>
</tr>
<tr>
<td>11</td>
<td>Eradicator</td>
<td>Sodium Lauryl Sulfate (1.5%), Sodium Chloride (0.5%) and Potassium Sorbate (0.06%)</td>
<td>Low mortality (&lt;50%)</td>
</tr>
<tr>
<td>12</td>
<td>Temprid SC</td>
<td>Imidacloprid</td>
<td>100% @ 3d</td>
</tr>
<tr>
<td>13</td>
<td>Demand CS</td>
<td>Lambda</td>
<td>Low mortality (&lt;50%)</td>
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</table>

- 60 bed bug nymphs per pesticide (presumably pyrethroid resistant)
- Directly sprayed at a rate of 1 gallon/1000 ft²

**Natural pesticides that ARE NOT regulated by the EPA**

**Synthetic pesticides that ARE regulated by the EPA**
Treating For Bed Bugs

You now should be familiar with:

- Insecticide resistance in bed bugs
- Tips for hiring a pest management professional (PMP)
- Inspection and monitoring options
- Ohio pesticide regulations
- Bed bug treatment options and general guidelines for:
  - Heat treatments
  - Insecticide treatments
- Efficacy data on various bed bug products
  - Registered insecticides
  - Natural products (exempt from EPA registration)
Acknowledgements

- Central Ohio Bed Bug Task Force
- Ohio Pest Management Association
- Ohio Department of Agriculture, Pesticide Regulation Section
- Survey participants
- Sarah Casey
- Alex Tyrpak
- Tae-Young Lee

Funding support:
- USDA National Institute of Food and Agriculture (NIFA), Hatch
- Extension IPM Program
Thank You!

Sleep tight,
and don’t let the ...

... well, you know the rest
Questions?