

# **The Emerging Tick Story: With an Ohio Emphasis**

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**Department of Entomology**  
**The Ohio State University**

## **The Emerging Tick Story: *With an Ohio Emphasis***



**Blacklegged ticks live in wooded habitats because of high humidity and host availability (white-footed mice, deer)**



**Blacklegged ticks are very small & active mainly during warm months**



**Early Lyme disease rash on side, usually visible around 7 days post tick attachment**

# Do we have a 'Big Tick' problem?



**DOC SLICES 14-POUND TICK FROM WOMAN'S BACK!**

**Bug imbedded itself into her flesh in 1987 — and grew & Grew & GREW!**

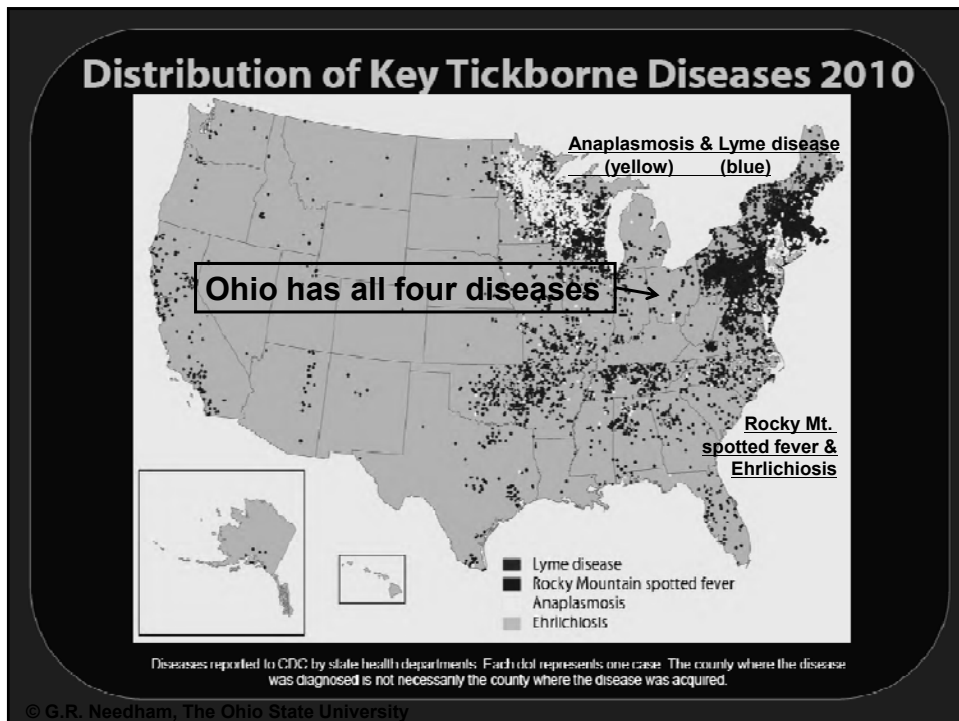
**Attached for 5 years**

**DOC SLICES 14-POUND TICK FROM WOMAN'S BACK!**

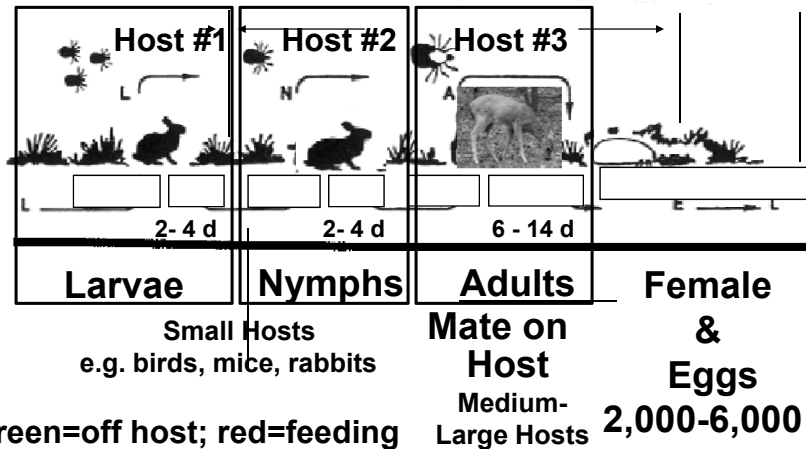
**Bug imbedded itself into her flesh in 1987 — and grew & Grew & GREW!**

**Attached for 5 years**

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**Tick Life Cycle: *Three Hosts***  
**Represents Most Common of 850 Tick Species**  
**May take 1, 2 or 3 years to complete cycle**



© G.R. Needham, The Ohio State University Figure adapted from drawing by P.D. Teel, Texas A&M University

**Common Disease-Transmitting  
Ticks Covered in this Unit**

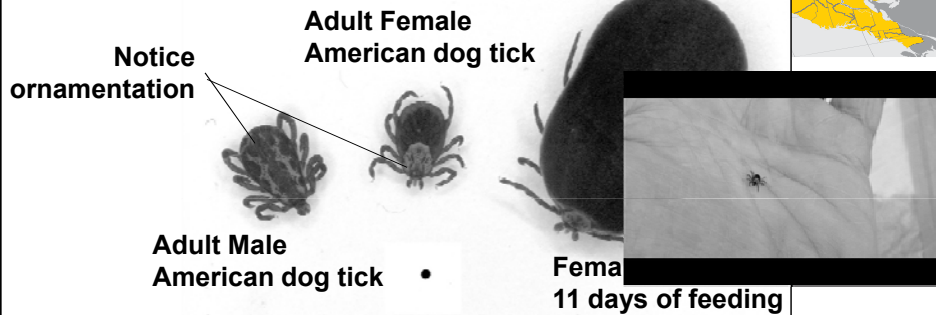
- | <b><u>Scientific Name</u></b>   | <b><u>Common name</u></b> |
|---------------------------------|---------------------------|
| – <i>Ixodes scapularis</i>      | Blacklegged ‘deer’ tick   |
| – <i>Amblyomma americanum</i>   | Lone star tick            |
| – <i>Dermacentor variabilis</i> | American dog tick         |

**~850 tick species worldwide, 12 in Ohio**

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## American Dog Tick, *Dermacentor variabilis* Found in grassy areas & along road edges

- Adults feed on medium to large mammals, e.g. dogs and humans
- Most active: April – July



Larvae and nymphs only rarely feed on pets or humans

"Photo used with permission from Ticks and Tick-borne Diseases in Iowa, Iowa State University Extension"

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## American dog tick adult

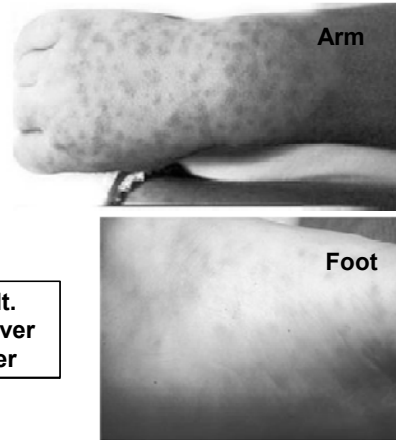
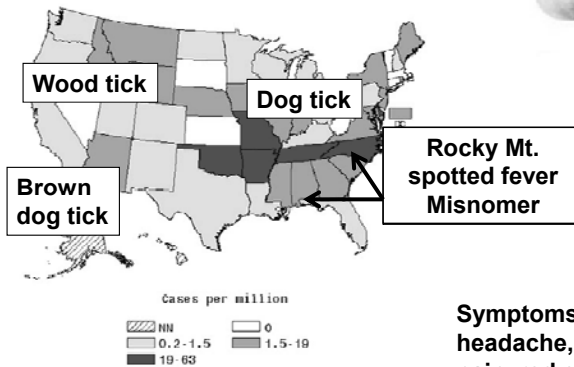




## Rock Mt. Spotted Fever

- Rocky Mt. spotted fever, can be fatal
- Tick must be attached for more than a day to transmit RMSF
- ~2,000 cases US, 15-25 cases in Ohio
- Three ticks transmit RMSF in US  
Brown dog tick in Central/SA

Early-stage rash  
on extremities (90%)



Symptoms: Fever, rash 2-5 days post-rash  
headache, nausea, vomiting, abdominal  
pain, red eyes. Can be fatal, 1<sup>st</sup> 8 days

<http://www.cdc.gov/rmsf/symptoms/index.html>

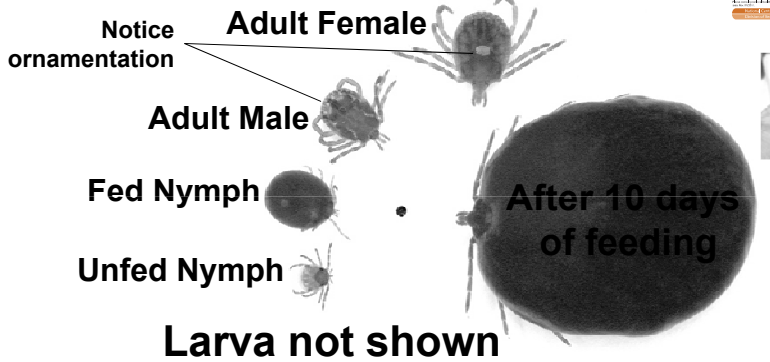
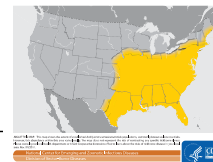
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## Lone Star tick, *Amblyomma americanum*

Found in shrubby, woody area habitats, aggressive biter

All stages (*larvae, nymphs, adults*) bite  
people, pets.

Active: April – August in Upper Midwest,  
longer in other regions



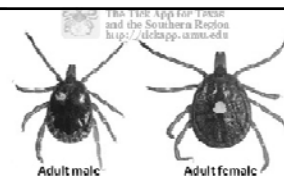
"Photo used with permission from Ticks and Tick-borne Diseases in Iowa, Iowa State University Extension"

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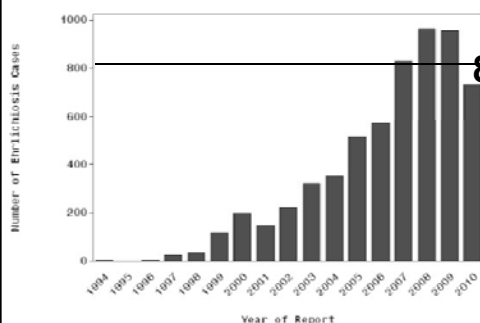
# Lone star tick nymph on hand



**Ehrlichiosis: *Three species***  
**Vector: *Lone star ticks***  
**Disease onset: *May-August***



Number of Annual Ehrlichiosis Cases, 1994-2010



Cases per million



**Symptoms: Fever, headache, chills, malaise, muscle pain, nausea, vomiting, diarrhea, confusion, rash (30% in adults), fatal 1.8%**

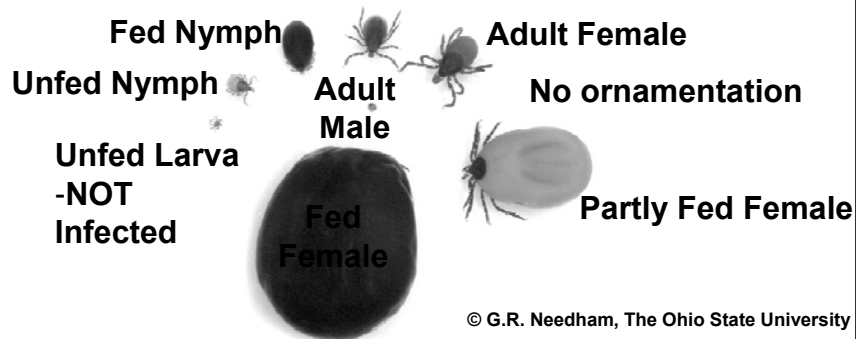
<http://www.cdc.gov/ehrlichiosis/stats/>

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## Blacklegged 'deer' tick, *Ixodes scapularis*

Lives in wooded habitats, active year around

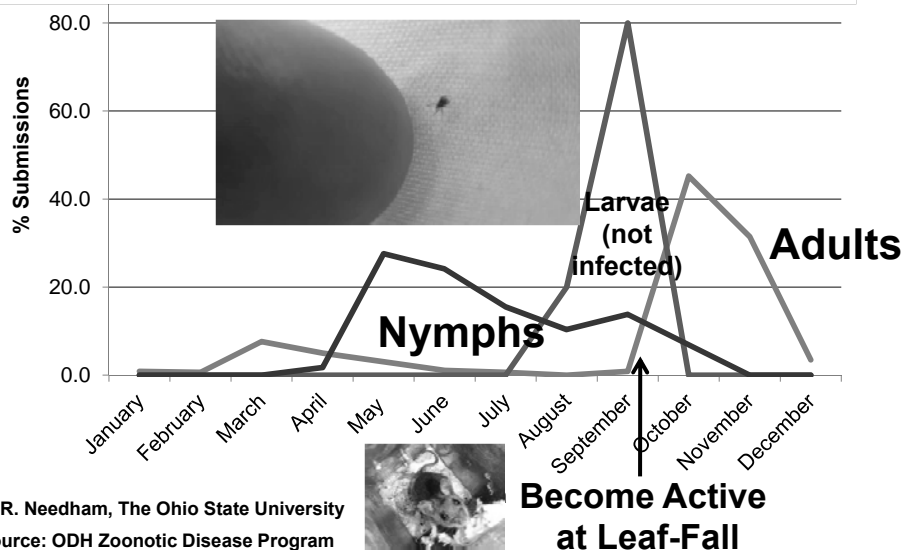
- Can carry Lyme disease, anaplasmosis, ehrlichiosis and babesiosis.
- Individual tick can transmit more than one disease when attached.
- Humans and dogs are most affected by these diseases.
- **All stages (larva, nymph, adults) bite people, pets, livestock.**



"Photo used with permission from Ticks and Tick-borne Diseases in Iowa, Iowa State University Extension"

## Blacklegged Tick Activity (Ohio)

*Nymphs infect naïve mice before larval emergence*



# Blacklegged 'deer' tick nymph



Reported Cases of Lyme Disease -- United States, 2001



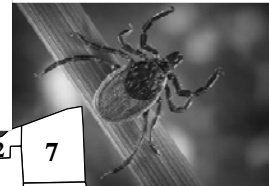
1 dot placed randomly within county of residence for each reported case

### Reported Cases of Lyme Disease -- United States, 2011

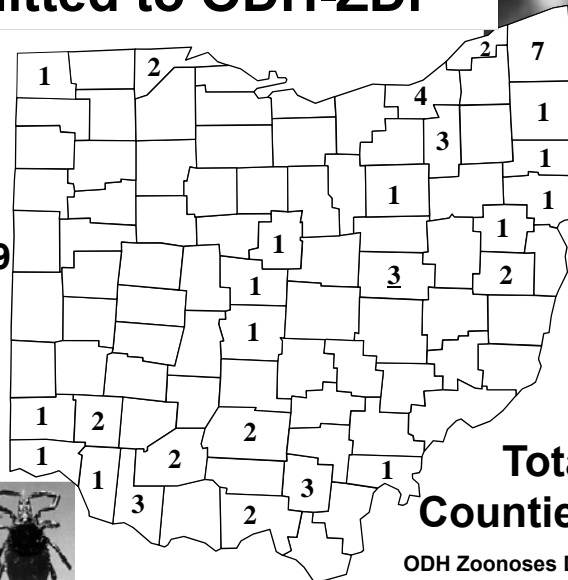


1 dot placed randomly within county of residence for each confirmed case

### Blacklegged Ticks submitted to ODH-ZDP



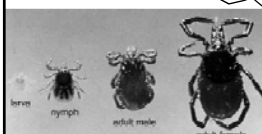
1989 – 2009



**Total : 51**  
**Counties : 26**

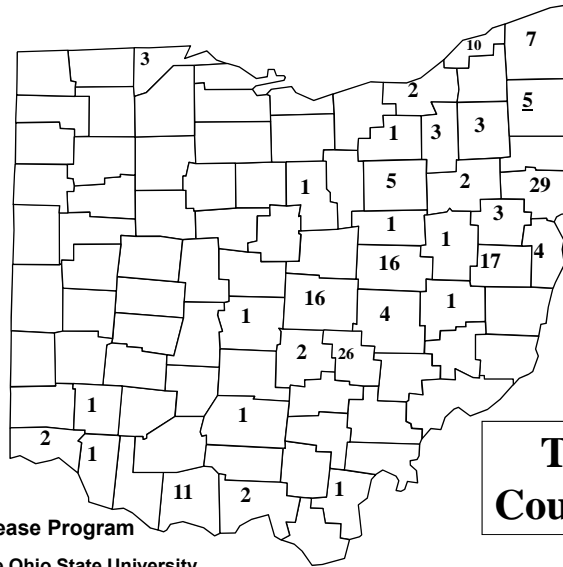
ODH Zoonoses Disease Program

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## Blacklegged Ticks submitted to ODH-ZDP in 2012

2012

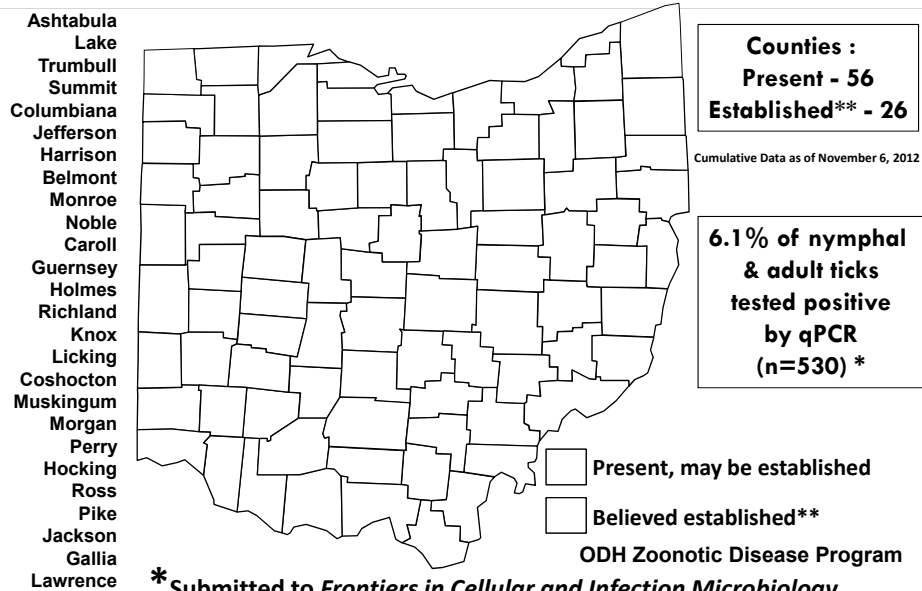


**Total : 182**  
**Counties : 31**

ODH Zoonotic Disease Program

© G.R. Needham, The Ohio State University

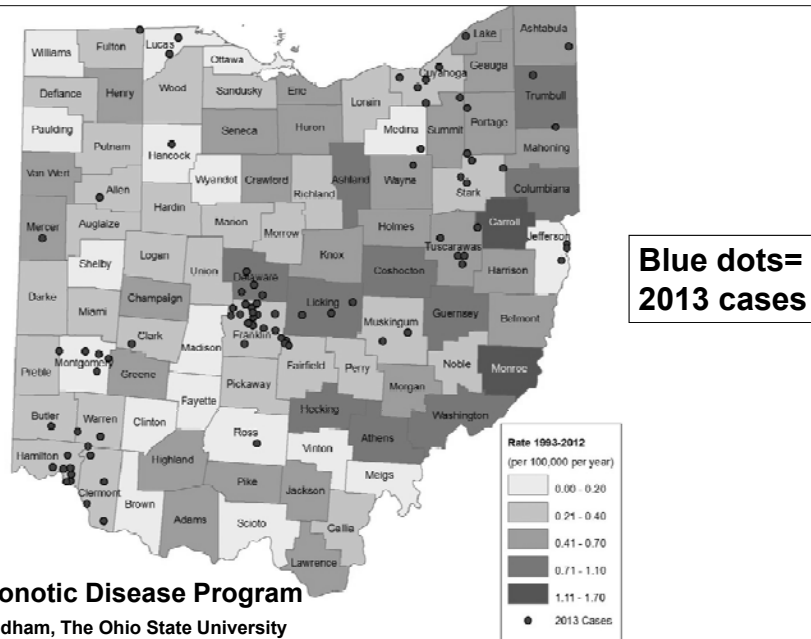
## Likely Distribution of *Ixodes scapularis*



\* Submitted to *Frontiers in Cellular and Infection Microbiology*

\*\* CDC criteria for "established" populations are at least 6 ticks or 2 life stages identified

## Ohio Lyme Endemic Counties



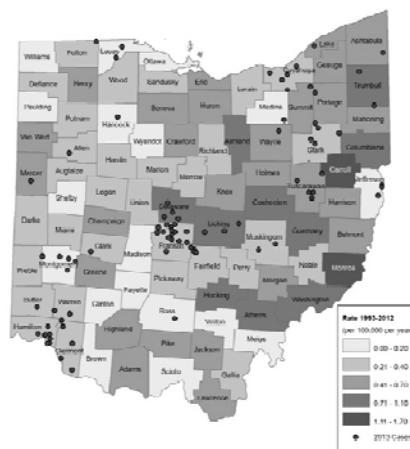
ODH Zoonotic Disease Program

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## Correlation of Cumulative Tick and Lyme Cases to 2012



**Tick Prevalence**



**Lyme Prevalence**

ODH Zoonotic Disease Program

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## CDC: Lyme Disease Transmission

- No evidence of *Person-to-Person* (STD?)



or *Pet to Person* Transmission.

- No evidence of transmission via blood.
- Lyme disease acquired during pregnancy may lead to infection of the placenta and possible stillbirth.

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## Lyme Disease: *Humans* *Borrelia burgdorferi* infection

### Localized Early Stage - 3-30 Days Post-Tick Bite

- Red, expanding rash called erythema migrans (EM).
- Rash may appear 3-30 days after tick bite (average, 7 days).
- Rash in 70-80% of cases, expands up to 12 inches.
- Rash usually feels warm, rarely itchy/painful.
- Fatigue, chills, fever, headache, muscle and joint aches and swollen lymph nodes.



Early EM or  
'bull's-eye  
rash'



Late EM

[http://www.cdc.gov/lyme/signs\\_symptoms/index.html](http://www.cdc.gov/lyme/signs_symptoms/index.html)

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## Early Disseminated Lyme Disease

### Days to Weeks Post-Tick Bite

Untreated, the disease may spread to other body sites, producing an array of symptoms that come and go:

- Additional EM lesions in other areas.
- Bell's (facial) palsy on one or both sides.
- Severe headaches and neck stiffness due to meningitis.
- Shooting pains, may interfere with sleep.
- Heart palpitations and dizziness.



[http://www.cdc.gov/lyme/signs\\_symptoms/index.html](http://www.cdc.gov/lyme/signs_symptoms/index.html)

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The Ohio State University

## Late Disseminated Lyme Disease

### Months to Years Post Tick Bite

- About 60% of patients with untreated Lyme may have intermittent arthritis, severe joint pain with swelling.
- Up to 5% of untreated patients may develop chronic neurological complaints months to years later, including shooting pains, numbness or tingling in hands/feet and short-term memory problems.



[http://www.cdc.gov/lyme/signs\\_symptoms/index.html](http://www.cdc.gov/lyme/signs_symptoms/index.html)

## **Lyme Disease Risk: *Consuming game***



- Will not get Lyme disease from eating venison or squirrel meat
  - Thoroughly cook game (no Sushi venison).
- Hunting & field dressing animals bring us into close contact with infected ticks.
- Risk of bringing ticks home.
- Take care in disposing deer hides (bury/burn).



<http://www.cdc.gov/lyme/>

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## **Tick Bite & Disease Prevention**

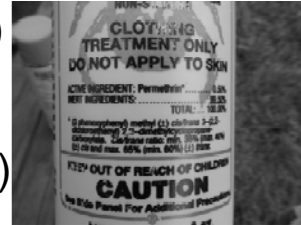


- Apply Tick Repellent
- Tuck Pants in Socks/Shirt in Pants
- Tick-Check Daily (esp. shower/toilet time)
- Remove Attached and Crawling Ticks (save them)
- Sample: 'flagging' or 'dragging' for risk assessment
- Develop a Tick-Safe Zone
- Veterinarians: Anti-tick Product Year-Around & Lyme Vaccine for Dogs

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## Tick Bite & Disease Prevention

- **Use repellents (follow label)**
  - DEET (clothing/skin)
  - Permethrin (pre-treat clothing)



- **Tuck pants** in socks/boots & shirt into pants (limit access).
- **Light-colored clothing to visualize crawling ticks.**



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## Tick Bite & Disease Prevention

- **Tick-Check at Shower Time**
- **Remove and save attached and crawling ticks**

**Only Blacklegged Ticks transmit Lyme disease.**  
(Includes instructions on "Blacklegged Ticks" or "Doe Ticks")  
(Includes pictures of "Blacklegged Ticks")

**Other ticks you might find biting**  
Lone Star Ticks, American Dog Ticks

**Daily TickCheck Shower Card**

Be TickSmart. Stay TickSafe!  
Check for ticks every day.

Find for hours & look for fine brown spots, especially in these areas:

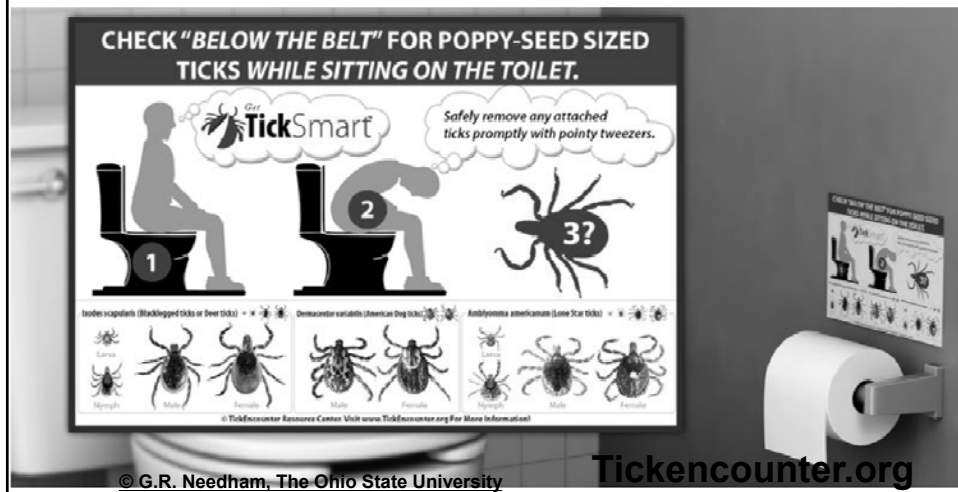
1. Scalp
2. Ears
3. Underarms
4. Belly Button
5. Waist & Back
6. Behind Knees
7. Pubic Area
8. In Between Legs

Tickencounter.org

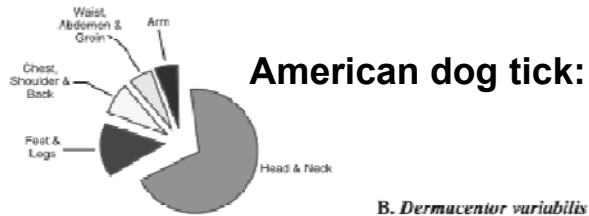
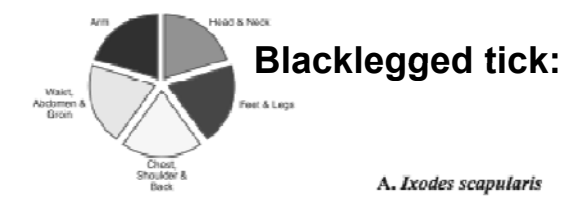
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# Tick Bite & Disease Prevention

- Tick-Check at Toilet Time
- Remove and save attached and crawling

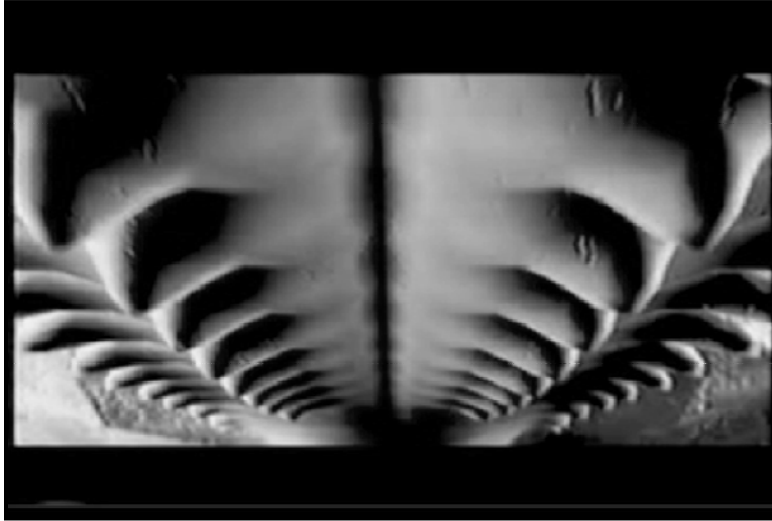


## Attachment Site Preferences on People



Source: Tick Management Handbook, CDC  
Kirby Stafford, CT

## **Attachment & Disease Transmission**



Courtesy Mona Lisa Productions  
[www.monalisa-prod.com](http://www.monalisa-prod.com)

© G.R. Needham, The Ohio State University

## **Deer Tick Removal from Dr. Hayes -Same for Pets-**



**Tweezers**

© G.R. Needham, The Ohio State University

## Tick Bite & Disease Prevention

- **Develop a Tick-Safe Zone**

- **Mow**
- **Mulch**
- **Fence**
- **Treat**
- **Note: bird feeders draw rodents, deer & birds that may carry ticks**



© G.R. Needham, The Ohio State University

Courtesy Kirby Stafford

## Tick Bite & Disease Prevention

- **Veterinarians: Disease Testing, Anti-tick Products & Vaccination**



**Monthly Medication  
& Daily Tick Checks**



**Lyme Vaccines**

**Prevent disease in dogs & cats  
that may also bring infected ticks  
in our yards and homes.**

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Courtesy K. Stafford III

## Tick/Lyme-Myth Busters & Prevention

- **MYTH:** Ticks jump from trees onto passing hosts
- **TRUTH:** Rarely found higher than your knees on plants, blacklegged ticks do not have eyes, so how would they 'time their jump'.



© G.R. Needham, The Ohio State University

## Tick/Lyme Myth Busters & Prevention

- **MYTH:** Hot match, fingernail polish, rubbing alcohol or petroleum jelly cause ticks to back out.
- **TRUTH:** None of them work, they may be dangerous and delay removal, increasing risk of disease transmission.

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## ***We have an emerging problem with a small tick***



**Blacklegged  
tick nymphs  
are active in  
the summer,  
adults will  
be active  
soon!**

**Save ticks in absolute ethanol or hand sanitizer**

© G.R. Needham

## **Resources**



THE  
OHIO  
STATE  
UNIVERSITY  
EXTENSION



# **FACT SHEET**

**Entomology**

HYG-2073-13

### **Ticks and Tick-Borne Diseases**

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Reynoldsburg, OH 43068

<http://tickapp.tamu.edu/>  
<http://www.tickencounter.org/>  
<http://www.cdc.gov/lyme/>  
**Buckeyes for Lyme Awareness**



# Acknowledgements

- *Ohio Department of Health:* Mary Daniels, Rich Gary, Kathy Smith
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- *Columbus Metro Parks:* Susan Boggs
- Kirby Stafford III, CT Ag. Exp. Station
- Karla Needham, RN
- US Air Force, Wright-Patterson AFB

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## Bed Bugs and Their Health Impacts

**Susan C. Jones, Ph.D.**  
Professor  
Department of Entomology  
The Ohio State University

## SPAIN

rischi di 28 ottobre 2010 a 18:38

## CANADA

Ministère de la Santé Publique

## ENGLAND

## AUSTRALIA

## Bed bugs eat into tourism

Edward C. Riddan is a lawyer.

A Letter from...

The region "don't like the big boys like" has taken on new significance for Americans browsing backpacker industry, which is being at epidemic of the Moccasinian issues. The bugs, which on a daily for tourists, are not feeding and are now found in the backwaters, travelling the world like in a basket, alone and drinking, and over the country's tourist industry. Tens of millions of people are being taken to have a different kind of so backpacker industry to spread a culture around about. Many backpackers, particularly in Brazil Beach and Kings Cross, rely heavily on alcohol and Irish pub culture.

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: minateurs.  
sont pas  
agent

# BED BUG NATION

BY MICHAEL F. POTTER, KENNETH F. HAYNES,  
JIM FREDERICKS AND MISSY HENRIKSEN

A pie chart showing the distribution of responses to the question 'Do you have a good idea of what you are doing?'. The chart is divided into two segments: a large grey segment labeled 'Yes' with 99.6% and a very small black segment labeled 'No' with 0.4%.

Response	Percentage
Yes	99.6%
No	0.4%

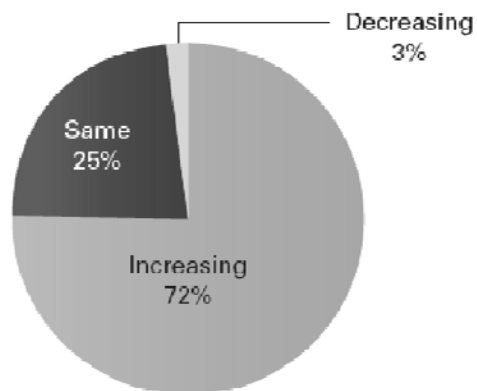
Sept/Oct 2013 Pestworld

## BED BUG NATION

### Are We Making Any Progress?

BY MICHAEL F. POTTER, KENNETH F. HAYNES,  
JIM FREDERICKS AND MISSY HENRIKSEN

**FIGURE 3. OVER THE PAST YEAR, DO YOU FEEL THE INCIDENCE OF BED BUGS IN YOUR REGION IS ...?**



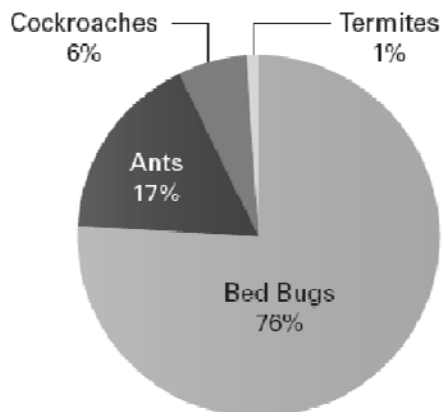
Sept/Oct 2013 Pestworld

## BED BUG NATION

### Are We Making Any Progress?

BY MICHAEL F. POTTER, KENNETH F. HAYNES,  
JIM FREDERICKS AND MISSY HENRIKSEN

**FIGURE 5. WHICH OF THE FOLLOWING PESTS DO YOU CONSIDER MOST DIFFICULT TO CONTROL?**



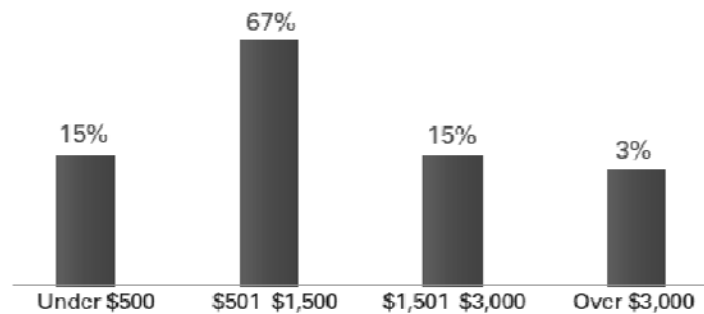
# BED BUG NATION

## Are We Making Any Progress?

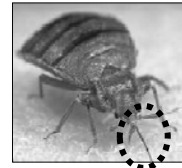
BY MICHAEL F. POTTER, KENNETH F. HAYNES,  
JIM FREDERICKS AND MISSY HENRIKSEN

**Bed bugs are responsible for severe economic hardships.**

**FIG 9. WHAT WAS THE AVERAGE AMOUNT YOUR RESIDENTIAL CUSTOMERS (SINGLE FAMILY HOMES) SPENT TREATING BED BUGS IN 2012?**



## The Common Bed Bug (*Cimex lectularius*) Hemiptera: Cimicidae



- Insects (true bugs)
- Temporary external parasites
- Feed only on blood
- Prefer to feed on humans
- Alternate hosts:  
rodents, bats, birds,  
pets (cats, dogs, etc.)



**Not caused by bad housekeeping!!  
BED BUGS CAN HAPPEN TO ANYONE!**

# Bed bugs are very good hitchhikers!

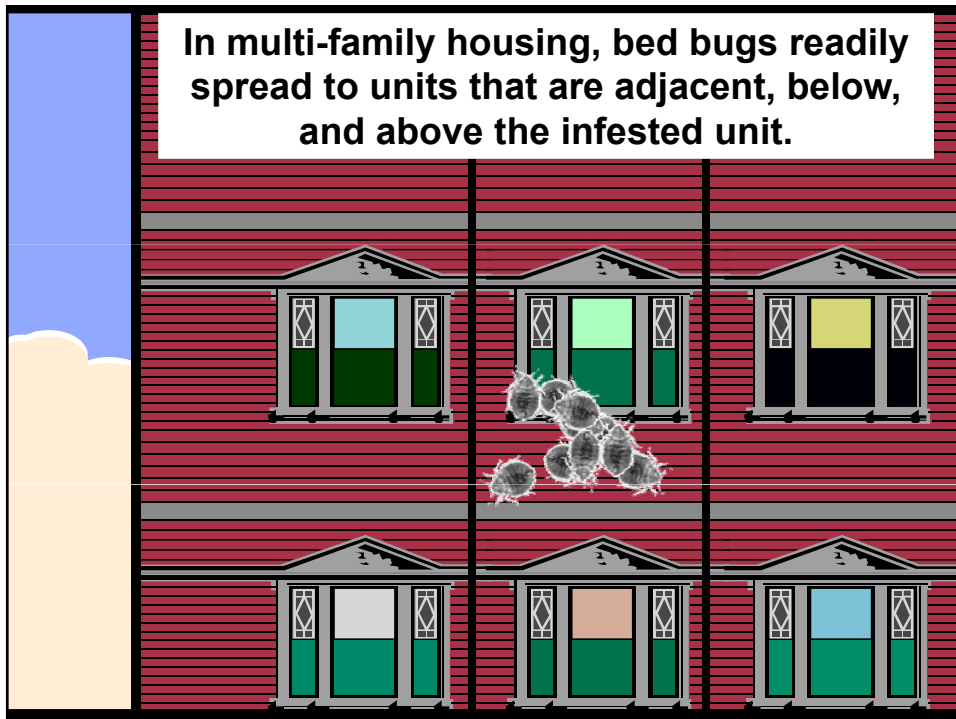


- Shoes and clothing
- Backpacks
- Purses and briefcases
- Walkers and wheelchairs
- Luggage
- Books
- MANY other items

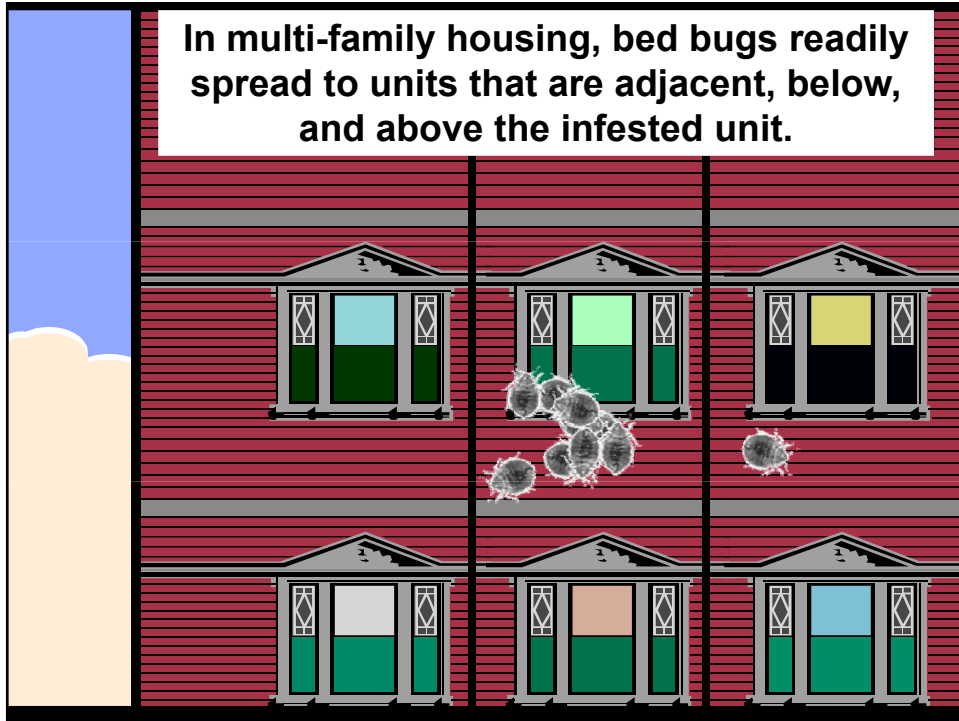


\*Photos courtesy of General Pest Control Co.

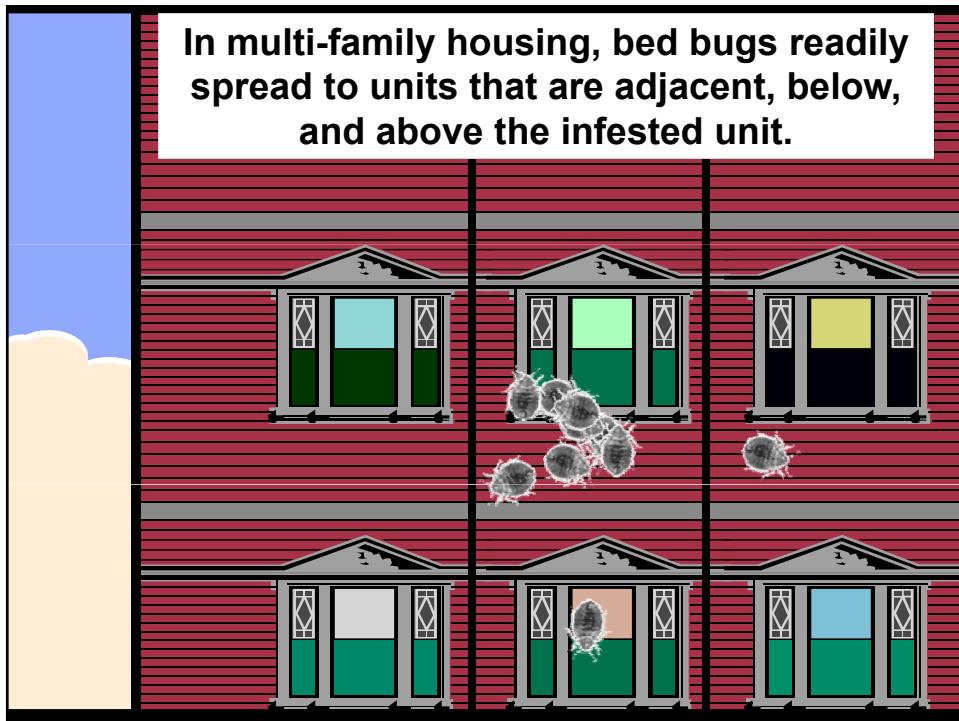
In multi-family housing, bed bugs readily spread to units that are adjacent, below, and above the infested unit.



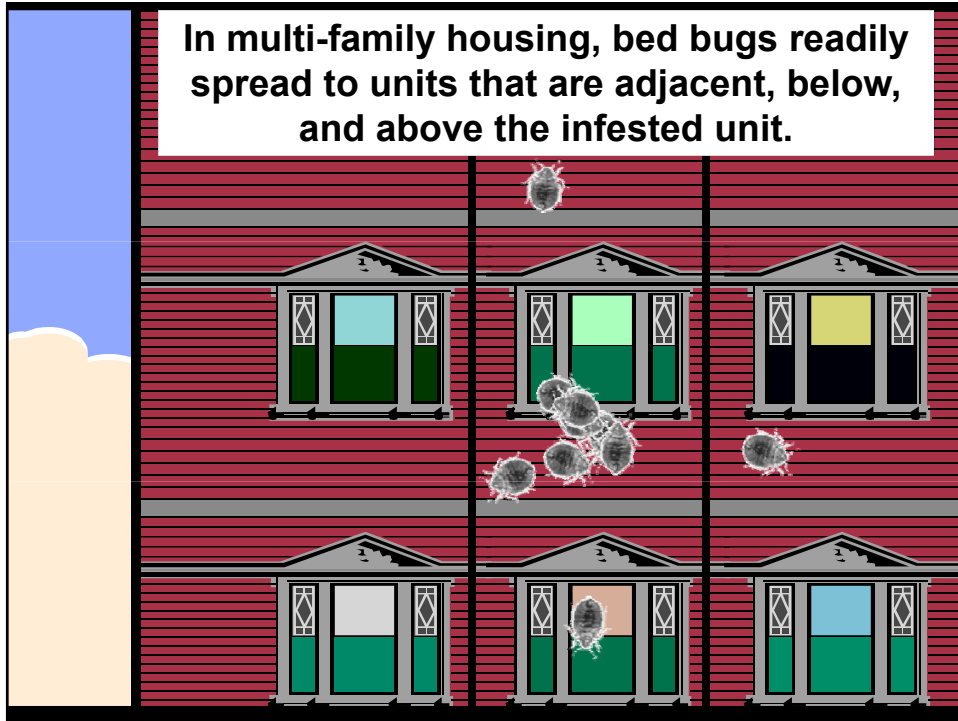
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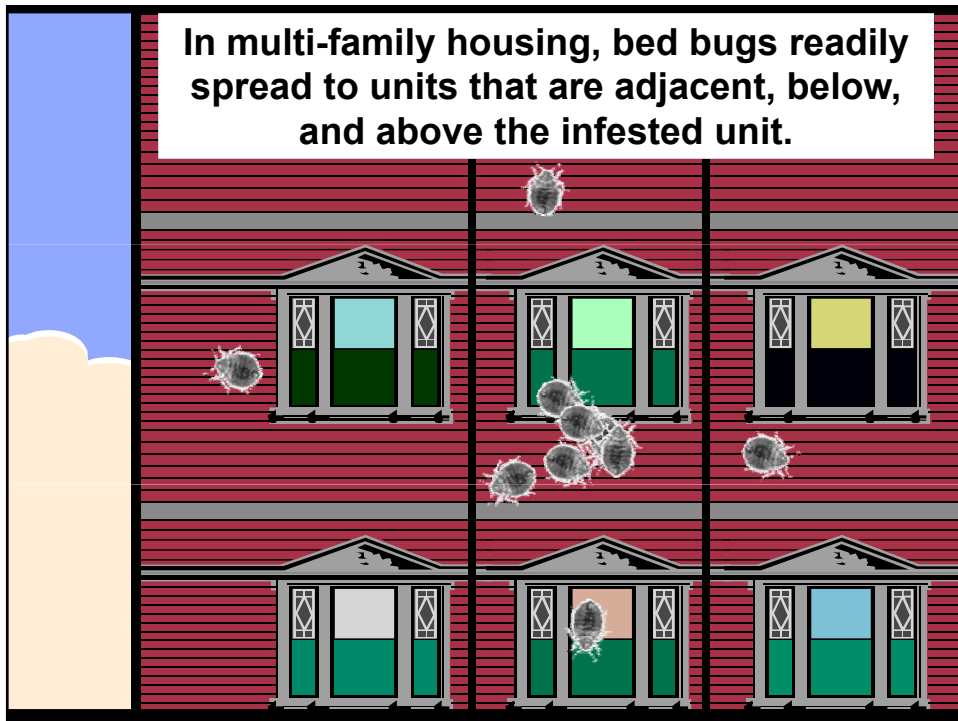
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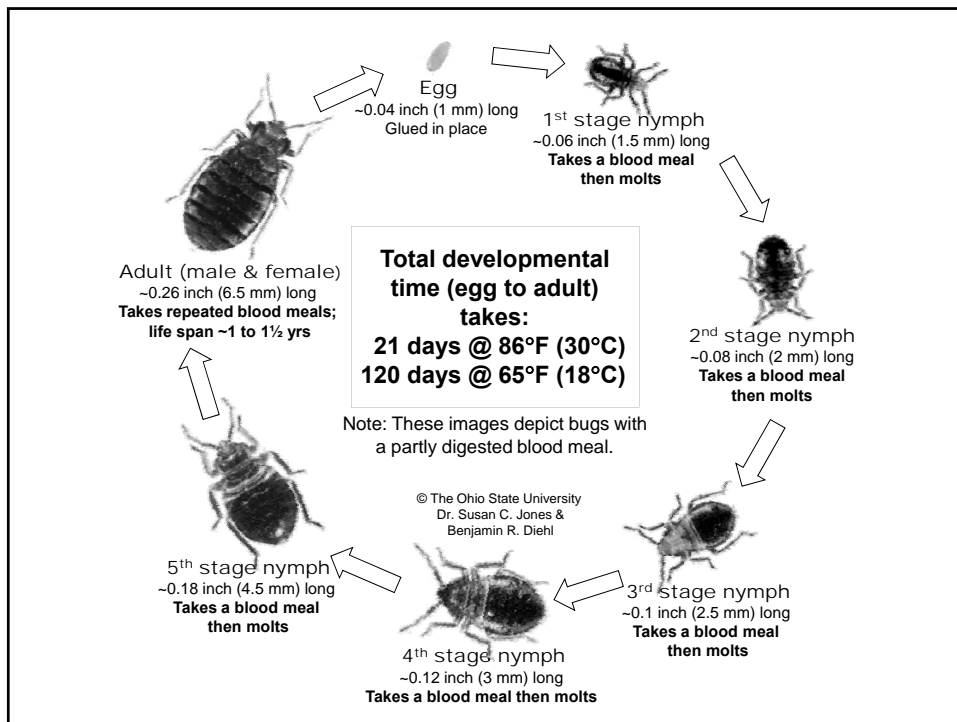


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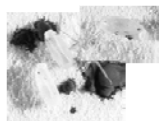


**In multi-family housing, bed bugs readily spread to units that are adjacent, below, and above the infested unit.**





## Life History Characteristics Show That Bed Bug Numbers Can Quickly Skyrocket ... (Early Detection and Treatment are Very Important)



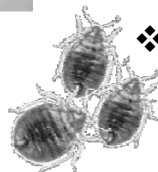
### ❖ Eggs

- Glued in place
- 1 – 12 eggs / day / female
- A single female can produce ~150 eggs
- Hatch in 6 – 17 days



### ❖ Nymphs (immature bugs)

- Five nymphal stages
- Require a blood meal in order to grow



### ❖ Adults (males & females)

- Require repeated blood meals
- Can live 12 – 18 months
- Can survive months of starvation



August 2010



**Joint Statement on Bed Bug Control in the United States from the U.S. Centers for Disease Control and Prevention (CDC) and the U.S. Environmental Protection Agency (EPA)**

**Introduction and Purpose**

The Centers for Disease Control and Prevention (CDC) and the U.S. Environmental Protection Agency (EPA) developed this document to highlight emerging public health issues associated with bed bugs (Cimex lectularius) in communities throughout the United States.

Bed bugs (*Cimex*) have been common in U.S. history. Although bed bug populations dropped dramatically during the mid-20th century (1), the United States is one of many countries now experiencing an alarming resurgence in the population of bed bugs. Though the exact cause is not known, experts suspect the resurgence is associated with increased resistance of bed bugs to available pesticides, greater international and domestic travel, lack of knowledge regarding control of bed bugs due to their prolonged absence, and the continuing decline or elimination of effective vector/pest control programs at state and local public health agencies.

In recent years, public health agencies across the country have been overwhelmed by complaints about bed bugs. An integrated approach to bed bug control involving federal, state, tribal and local public health professionals, together with pest management professionals, housing authorities and private citizens, will promote development and understanding of the best methods for managing and controlling bed bugs and preventing future infestations. Research, training and public education are critical to an effective strategy for reducing public health issues associated with the resurgence of bed bug populations.

**Impact of Bed Bugs on Public Health**

Although bed bugs are not known to transmit disease, they are a pest of significant public health importance. Bed bugs fit into a category of blood-sucking ectoparasites (external parasites) similar to head lice (*Phthirus humanus corporis*). Bed bugs, like head lice, feed on the blood of humans but are not believed to transmit disease. Other ectoparasites, such as body lice (*Phthirus humanus corporis*), are known to transmit several serious diseases. Differences in the biology of similar species of pests, such as body lice and head lice (or bed bugs) can greatly impact the ability of pests to transmit disease.



Photo: S. Bed Bug. Photo courtesy of Dr. Harold Mullen, Kansas State Management-Based Insects Library

## CDC & EPA Joint Statement

**Bed bugs are a  
pest of significant  
public health  
importance!**

[http://www.cdc.gov/nceh/ehs/Publications/Bed\\_Bugs\\_CDC-EPA\\_Statement.htm](http://www.cdc.gov/nceh/ehs/Publications/Bed_Bugs_CDC-EPA_Statement.htm)

<http://www.epa.gov/pesticides/bedbugs/>

## Health Effects from Bed Bugs

- Skin reactions in 70% of people (avg.)



- Redness
- Welts
- Itching



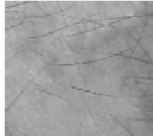
- Secondary bacterial infections
- Anemia
- Asthma



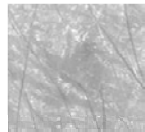
- Anaphylactic shock
- Psychological effects
- Sleeplessness
- Agitation
- Anxiety ...

## Bed Bug Bites (Cimicosis)

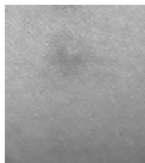
Wide range of skin lesions (with or without severe itching [pruritus]):



- Small macular spots
  - flat spots with surface color (<5 or 10 mm dia)



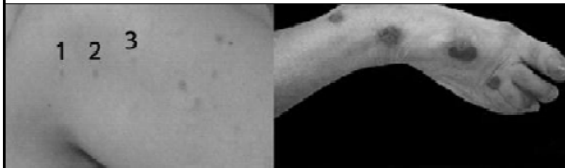
- Papules
  - solid skin elevations (<5 or 10 mm dia)



- Plaques
  - a broad papule or confluence of papules ( $\geq 1$  cm)
- Prominent wheals
  - rounded or flattened pale red papules or plaques that disappear within 24-48 hrs
- Bullae (fluid-filled blisters)

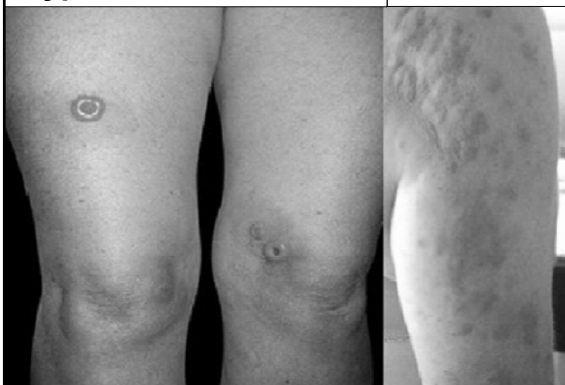
## Clinical Manifestations of Bed Bug Bites (Cimicosis)

common distribution of skin lesions

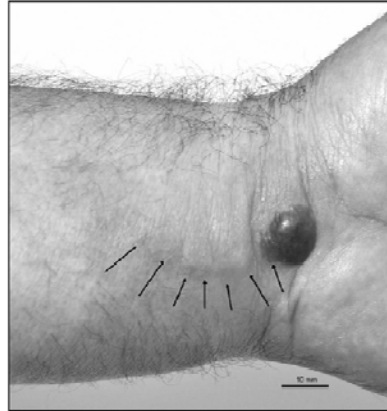


atypical bullous lesions

urticaria



- Typically on exposed skin
- Often in groups or rows

**Bullous Reactions to Bedbug Bites Reflect Cutaneous Vasculitis**Richard D. deShazo, MD,\* Mark F. Feldlaufer, PhD,<sup>§</sup> Martin C. Mihn, Jr, MD,\* Jerome Goddard, PhD<sup>¶</sup><sup>\*</sup>Division of Clinical Immunology and Allergy, Departments of Medicine and Pediatrics, The University of Mississippi Medical Center, Jackson; <sup>§</sup>Invasive Insect Biocontrol and Behavior Laboratory, US Department of Agriculture, Beltsville, MD; <sup>¶</sup>Department of Pathology, Harvard Medical School, Boston, Mass; <sup>¶</sup>Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology, Mississippi State University, Mississippi State.

**Figure 1** Bullous reaction from an accidental bite of a *C. lectularius* nymph 24 hours after the bite. There is a visible path where the nymph appears to have probed before feeding at the main site (arrow). Line equals 10 mm.



**Figure 3** Sequential photographs of a bedbug feeding site in our study subject between 24 hours and 4 weeks. There was progression from blister to bulla, lysis of bulla, and gradual healing at the bulla base with scarring and hyperpigmentation.

## Diagnosing Bed Bug Bites

- **Diagnosis of a bed bug bite is speculative.**
- **Confirmation is based on bed bug evidence.**
  
- **Resemble bites from other insects & arthropods**
- **Typically no red puncture spot at the center**  
(such as with fleas and black flies)
- **Rarely occur on the palms or soles**  
(such as with scabies mites)
- ...

## Anemia From Bed Bug Bites

TRANSACTIONS OF THE ROYAL SOCIETY OF  
TROPICAL MEDICINE AND HYGIENE.  
Vol. 56. No. 3. May, 1962.

India

### LOSS OF HAEMOGLOBIN IRON DUE TO EXCESSIVE BITING BY BED BUGS

A POSSIBLE AETIOLOGICAL FACTOR IN THE IRON DEFICIENCY ANAEMIA OF  
INFANTS AND CHILDREN

BY

P. S. VENKATACHALAM AND BHAVANI BELAVADY

*Nutrition Research Laboratories, Indian Council of Medical Research, Hyderabad.*

CMAJ

PRACTICE

Canadian Medical Association Journal 181: 287–88.

CASES

### Severe anemia from bedbugs

M. Jane Pritchard MD, Stephen W. Hwang MD MPH

Previously published at [www.cmaj.ca](http://www.cmaj.ca) on Aug. 31, 2009.

Canada

## Anemia From Bed Bug Bites

Parasitol Res (2012) 110:2577–2579  
DOI 10.1007/s00436-011-2277-6

SHORT COMMUNICATION

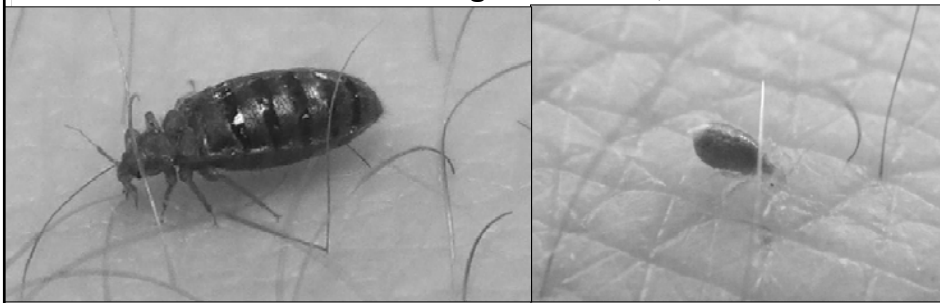
Austria

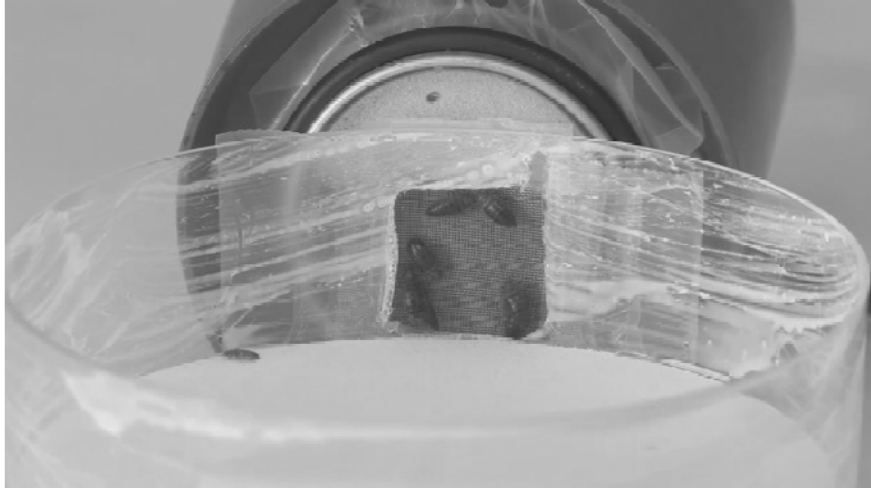
Bed bugs can cause severe anaemia in adults

Maria Paulke-Korinek · Marton Széll ·  
Hermann Lafertl · Herbert Auer · Christoph Wenisch

A single blood meal of an adult bed bug may have a volume of up to 7 mm<sup>3</sup>. Therefore, it would take a minimum of 286,000 bites to suffer a blood loss of 2 liters.

“...the number of bites suffered by the (two) victims ... must have been far larger than 286,000.”





# CLINICAL REVIEW

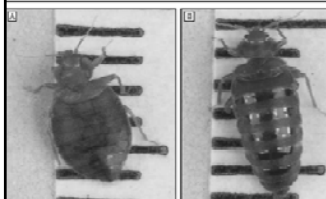
# CLINICIAN'S CORNER

2009. JAMA 301(13): 1358-1366.

## Bed Bugs (*Cimex lectularius*) and Clinical Consequences of Their Bites

Jerome Goldard, PhD  
Richard deShazo, MD

Figure 1. Adult Bed Bug Before and After a Human Blood Meal Feeding



**“There are few data to support bed bugs as vectors for transmission of human disease agents. ... transmission of a human disease is yet to be firmly established.”**

## Psychological Effects of Bed Bug Attacks (*Cimex lectularius* L.)

Jerome Goddard, PhD,<sup>a</sup> Richard de Shazo, MD<sup>b</sup>

<sup>a</sup>Department of Biochemistry, Molecular Biology, Entomology, and Plant Pathology, Mississippi State University, Mississippi State, Miss; <sup>b</sup>Departments of Medicine and Pediatrics, Division of Clinical Immunology and Asthma, University of Mississippi Medical Center, Jackson.

### ABSTRACT

**BACKGROUND:** In some individuals, psychological sequelae resulting from bed bug biting events include nightmares, flashbacks, hypervigilance (to keep the bugs away), insomnia, anxiety, avoidance behaviors, and personal dysfunction. These symptoms are suggestive of posttraumatic stress disorder (PTSD).

**METHODS:** We used a previously published PTSD checklist to analyze online blogs and other Internet sites where bed bug postings occur to assess postings for evidence of emotional trauma.

**RESULTS:** One hundred thirty-five postings were read and analyzed, and 110 (81%) of those postings reported psychological effects from bed bug infestations. Scoring with the PTSD checklist revealed a range of 0-52 (mean 13.25; SD 9.38); one met the criteria ( $\geq 50$ ) considered positive for PTSD.

**CONCLUSIONS:** Based upon our survey of online postings concerning such effects, an as-yet-to-be-determined proportion of individuals who experience bed bug bites develop moderate-to-severe negative emotional symptoms after infestations. These individuals should be identified in the course of their interactions with health professionals so that appropriate mental health care may be provided.

© 2012 Published by Elsevier Inc. • *The American Journal of Medicine* (2012) 125, 101-103

**KEYWORDS:** Bed bugs; Bite reactions; Health effects; PTSD

### Case Reports

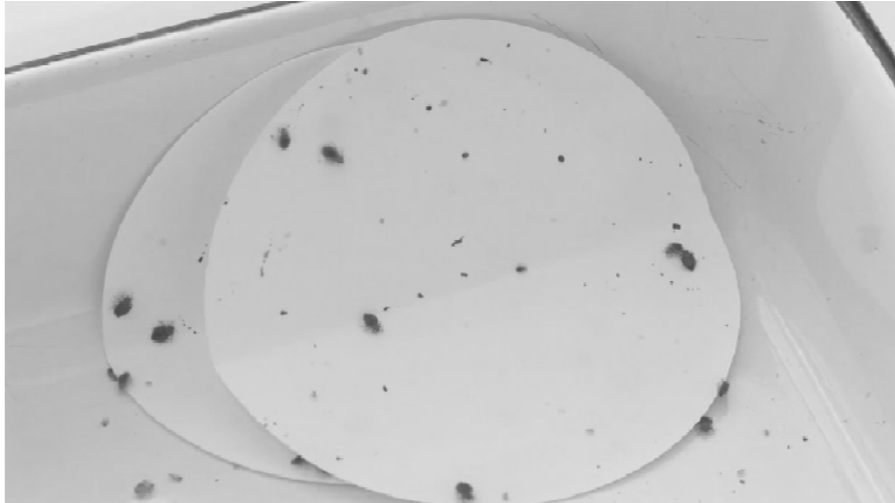
## Psychiatric Consequences of Actual Versus Feared and Perceived Bed Bug Infestations: A Case Series Examining a Current Epidemic

Evan Rieder, M.D., Gareen Hamalian, M.D., M.P.H., Katherine Maloy, M.D.,  
Elizabeth Streicker, M.D., Lucas Sjulson, M.D., Ph.D., Patrick Ying, M.D.

Bed bugs have plagued humans since the beginning of history and have been mentioned in classical Greek writings dating back to the era of Aristotle as well as in medieval European texts.<sup>1,2</sup> With the introduction of the pesticide dichlorodiphenyltrichloroethane (DDT) in the 1950s, bedbugs were virtually eradicated in the United States. However, with the ban of DDT in 1972, increasing

the usual response to a bed bug bite is no reaction with a minimally visible punctum at the location of the bite.<sup>12</sup>

Bed bugs present unique difficulties relative to other common pests that are active at night, such as rodents and roaches. Bed bugs are attracted to warmth and blood, feed on human hosts and may not leave any obvious cutaneous sequelae. Bites may lead to fear of repeat attacks, elabo-



## Pesticide Misuse

Centers for Disease Control and Prevention

**MMWR**

Morbidity and Mortality Weekly Report

Weekly / Vol. 60 / No. 37

September 23, 2011

### Acute Illnesses Associated With Insecticides Used to Control Bed Bugs — Seven States, 2003–2010

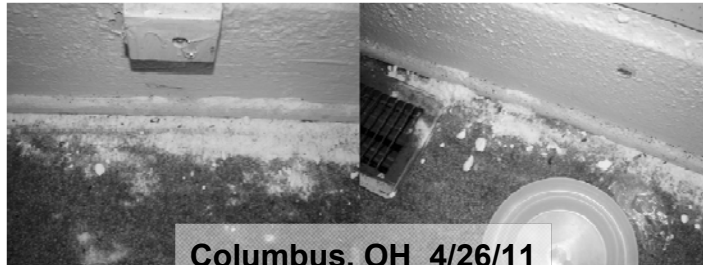
**TABLE 2. (Continued) Characteristics of acute illnesses associated with insecticides used for bed bug control — seven states, 2003–2010**

Characteristic	Total	
	No.	(%) <sup>a</sup>
<b>Work related<sup>b</sup></b>		
Yes	13	(12)
<b>Pesticide applicator certification</b>		
Certified applicator	2	(2)
Uncertified/Unsupervised applicator	15	(14)
Home occupant not certified to apply pesticides	43	(39)
Unknown certification of applicator	51	(46)

**TABLE 3. Contributing factors in acute illnesses associated with insecticides used for bed bug control — seven states, 2003–2010**

Contributing factor	Total	
	No.	(%) <sup>a</sup>
One or more contributing factors identified <sup>b</sup>	56	(100)
Excessive application	10	(18)
Failure to wash or change pesticide-treated bedding	9	(16)
Notification lacking/ineffective	6	(11)
Failure to vacate premises	5	(9)
Spill/Splash of liquid or dust	4	(7)
Inadequate ventilation <sup>c</sup>	3	(5)
Early reentry	2	(4)
Mixing incompatible chemicals	2	(4)
Improper storage	1	(2)
Label violation not otherwise specified <sup>d</sup>	16	(29)
No label violation but person still ill	2	(4)

## Pesticide Misuse By Desperate Residents With Bed Bugs



Columbus, OH 4/26/11



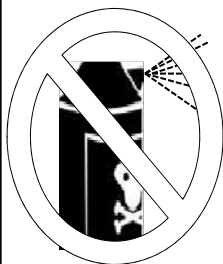
Columbus, OH 6/28/12

### ***What shouldn't people do for a bed bug problem?***

Recommendation Summary:  
Ineffectiveness of Over-the-Counter Total Release Foggers Against the Bed Bug (*Cimex lectularius*, Cimicidae)  
JOURNAL OF PEST MANAGEMENT, 2012, 93(1), 1-10  
Department of Entomology, The Ohio State University, 1680 Neil Avenue, Columbus, OH 43210-1229

A Total Release Fogger (TRF) was evaluated against bed bugs (Cimex lectularius) in a laboratory setting. The TRF was found to be ineffective against bed bugs, and the results suggest that the use of TRFs for bed bug control is not recommended. The study was conducted in a laboratory setting, and the results may not be representative of field conditions. The study was conducted in a laboratory setting, and the results may not be representative of field conditions. The study was conducted in a laboratory setting, and the results may not be representative of field conditions.

- “Bug Bombs” (over-the-counter “foggers”) won’t control bed bug infestations.
- “Bug Bombs” may cause bed bugs to scatter!!!



***“Bug Bombs” can worsen the bed bug problem!!***



**It's advisable to hire a licensed pest control professional to treat for bed bugs.**

**Once you've made sure they are properly licensed to apply pesticides:**

- **Obtain at least 3 estimates.**
- **Check for satisfied customer references that relate to bed bug control.**
- **Recognize that bed bug control typically takes several insecticide treatments.**

### **Treatment Options** **(more than one often are used concurrently)**

- **Insecticides**
  - **Residual products** (dust, liquid, aerosols)
  - **Fumigation** (sulfuryl fluoride)
- **Heat treatment** (whole structure, container)
- **Steam**
- **Cold** (usefulness is limited)
- **Sanitation measures**

## ***Some Basics of Bed Bug Management Using Insecticides***



- There is no single “magic bullet”.
- A residual insecticide is necessary.
- Control of a bed bug infestation typically takes several treatments.
- It is important to use several different formulations, and often, several different insecticides.
- Don’t keep using the same insecticide (rotate insecticide use)

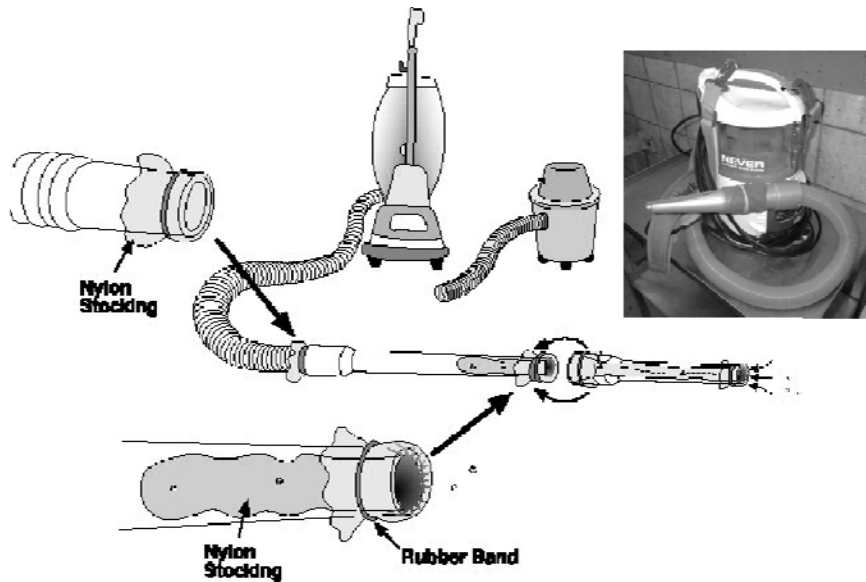
## ***Some measures to help reduce the number of bed bugs:***

### **Laundry bedding, clothing, etc.!**

- Wash in hot water (>120°F, [50°C])
- Keep dry items in drier on medium to hot setting for >30 minutes.



## Vacuuuming to contain bed bugs



Jones and Boggs. 2001. OSU Fact Sheet HYG-2158.

## --Summary--

### Health Effects from Bed Bugs



- Skin reactions
- Secondary bacterial infections
- Anemia
- Asthma
- Anaphylactic shock
- Psychological effects
- Sleeplessness
- Agitation
- Anxiety ...