

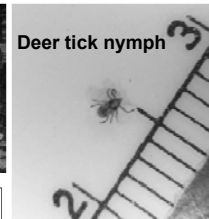
The Emerging Tick Story: With an Ohio Emphasis

Dr. Glen Needham, Ph.D.
Associate Professor Emeritus
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)



Deer tick nymph

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!

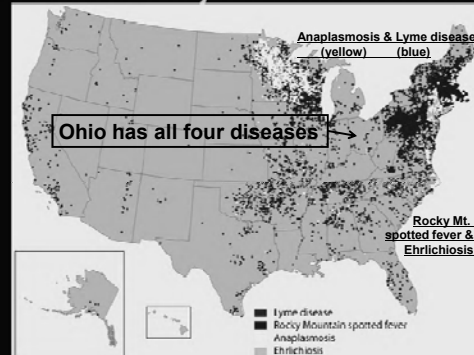
TICK FROM WOMAN'S BACK!

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

Attached for 5 years

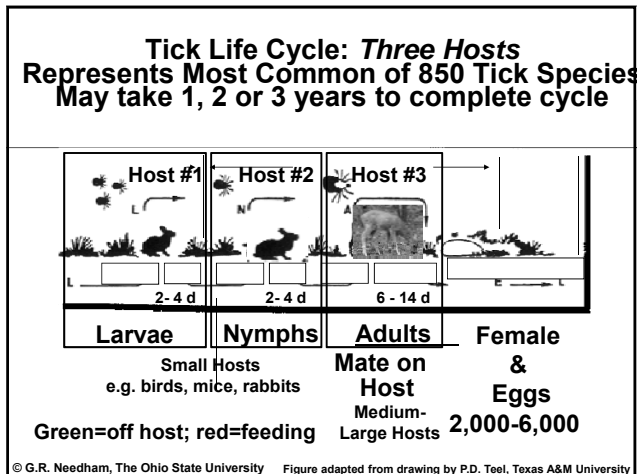
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Distribution of Key Tickborne Diseases 2010



Diseases reported to CDC by state health departments. Each dot represents one case. The county where the disease was diagnosed is not necessarily the county where the disease was acquired.

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Common Disease-Transmitting Ticks Covered in this Unit

<u>Scientific Name</u>	<u>Common name</u>
– <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

Notice ornamentation

Adult Female American dog tick

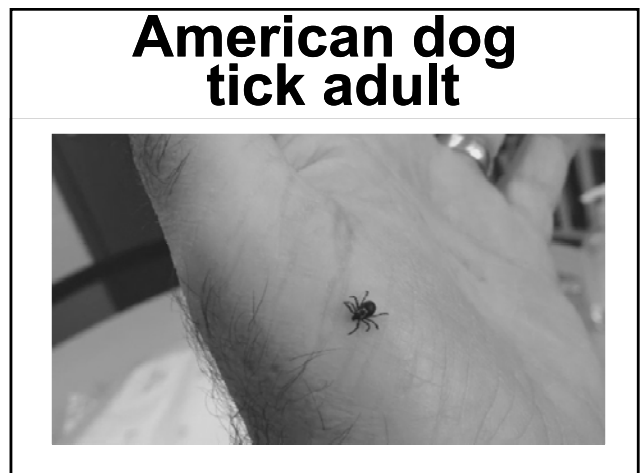
Adult Male American dog tick

Female 11 days of feeding

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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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

Wood tick, Dog tick, Brown dog tick, Rocky Mt. spotted fever, Misnomer

Early-stage rash on extremities (90%)

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

<http://www.cdc.gov/rmsf/symptoms/index.html> © G.R. Needham, The Ohio State University

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

Notice ornamentation

Adult Female

Adult Male

Fed Nymph

Unfed Nymph

Larva not shown

After 10 days of feeding

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

Adult male, Adult female

Number of Annual Ehrlichiosis Cases, 1994-2010

8000

Year of Report

Cases per million

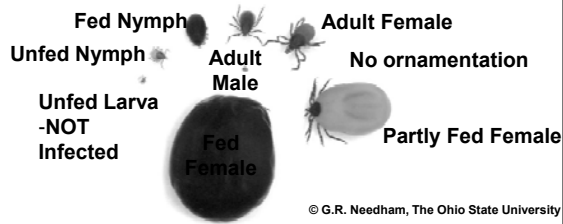
Symptoms: Fever, headache, chills, malaise, muscle pain, nausea, vomiting, diarrhea, confusion, rash (30% in adults), fatal 1.8%

<http://www.cdc.gov/ehrlichiosis/stats/> © G.R. Needham, The Ohio State University

Blacklegged 'deer' tick, *Ixodes scapularis*

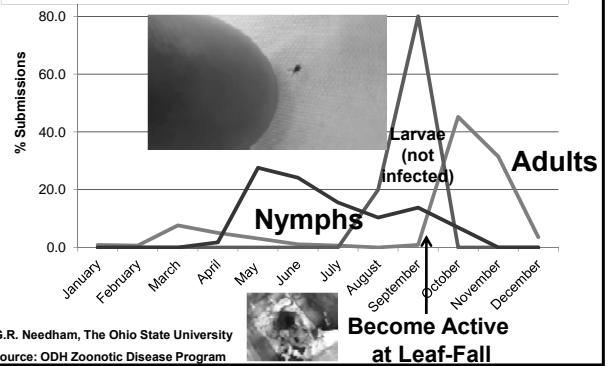
Lives in wooded habitats, active year around

- 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.



Blacklegged Tick Activity (Ohio)

Nymphs infect naïve mice before larval emergence

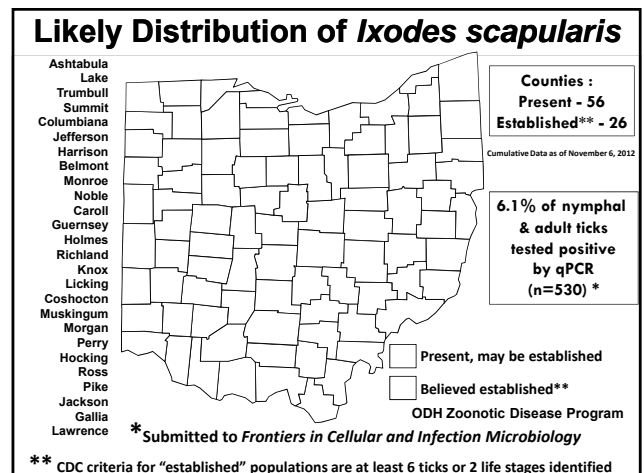
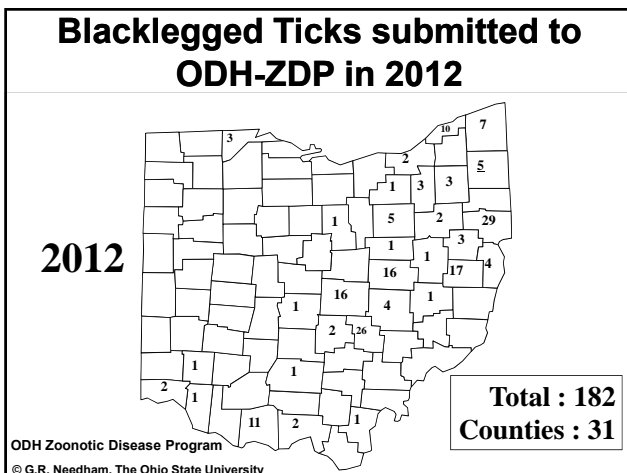
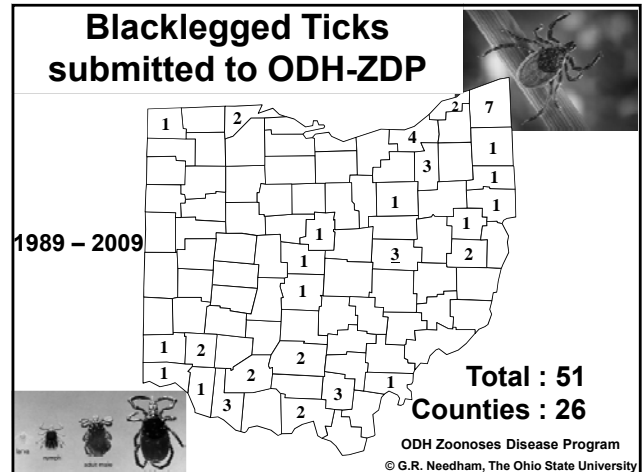
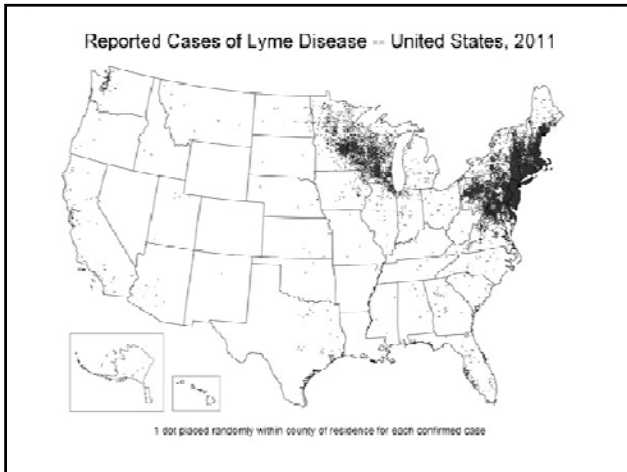


Blacklegged 'deer' tick nymph

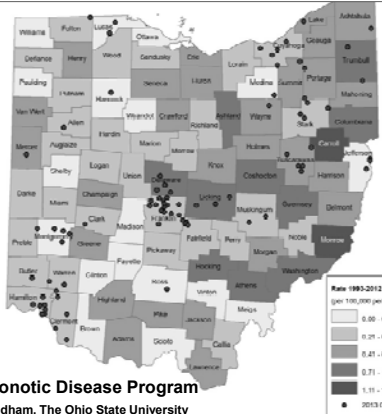


Reported Cases of Lyme Disease -- United States, 2001





Ohio Lyme Endemic Counties



Blue dots=
2013 cases

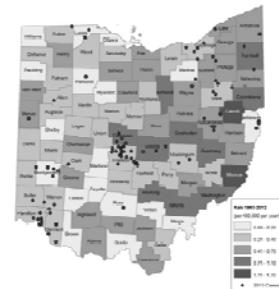
ODH Zoonotic Disease Program

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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.**



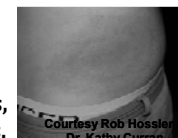
- **No evidence of transmission via blood.**
- **Lyme disease acquired during pregnancy may lead to infection of the placenta and possible stillbirth.**

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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.



Courtesy Rob Hossler
Dr. Kathy Curran

Early EM or
'bull's-eye
rash'



Late EM

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

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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

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

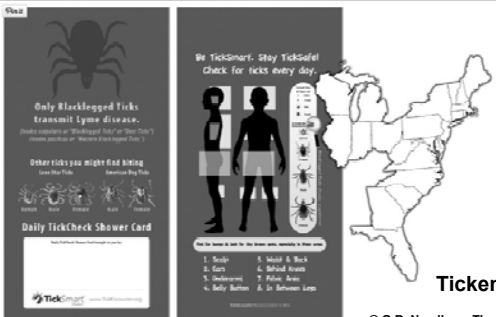
- **Use repellents (follow label)**
 - DEET (clothing/skin)
 - Permethrin (pre-treat clothing)
- **Tuck pants** in socks/boots & shirt into pants (limit access).
- **Light-colored clothing to visualize crawling ticks.**

© G.R. Needham, The Ohio State University

Tick Bite & Disease Prevention

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



© G.R. Needham, The Ohio State University


Tick Bite & Disease Prevention

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




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Attachment Site Preferences on People



No Preference

Blacklegged tick

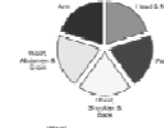


Head & Neck

American dog tick

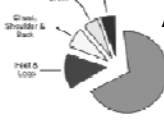
Blacklegged tick:

A. eximius scapularis



American dog tick:

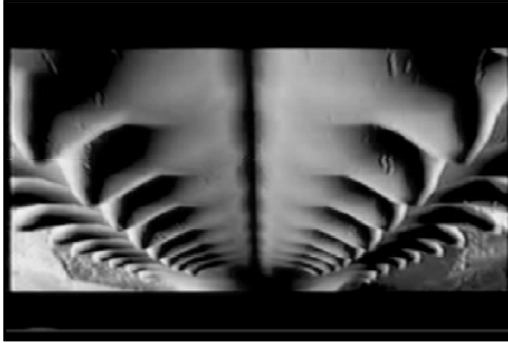
B. Dermacentor variabilis



Source: Tick Management Handbook, CDC
Kirby Stafford, CT

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Attachment & Disease Transmission



Courtesy Mona Lisa Productions
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



Courtesy Kirby Stafford

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Tick Bite & Disease Prevention

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



Monthly Medication
& Daily Tick Checks



Lyme Vaccines

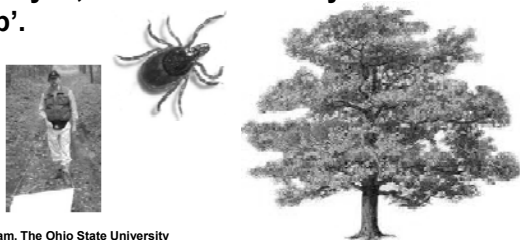
Prevent disease in dogs & cats that may also bring infected ticks in our yards and homes.

© G.R. Needham, The Ohio State University

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

FACT SHEET

Entomology

HYG-2073-13

Ticks and Tick-Borne Diseases

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<http://tickapp.tamu.edu/>
<http://www.tickcounter.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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- 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

Worldwide Resurgence of Bed Bugs Since Late 1990s

Aumenta la presencia de chinches en Barcelona

Los esfuerzos de control de plagas decantan su desaparición han incrementado las actuaciones contra estos insectos en

SPAIN

March 26 article 2010 a 104308

CANADA
Montréal: épidémie de punaises de lit confirmée

THE SUNDAY TIMES

Archive Article Please enjoy this article from The

From The Times

April 14, 2004

Bedbugs invade London's

By Valerie Ebbitt, Consumer Editor

LONDON'S student hotels are among a string of residential properties throughout the country which are facing an invasion 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

guardian.co.uk

Bed bugs eat into tourism

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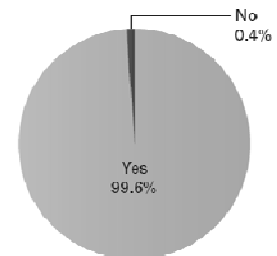
Sept/Oct 2013 Pestworld

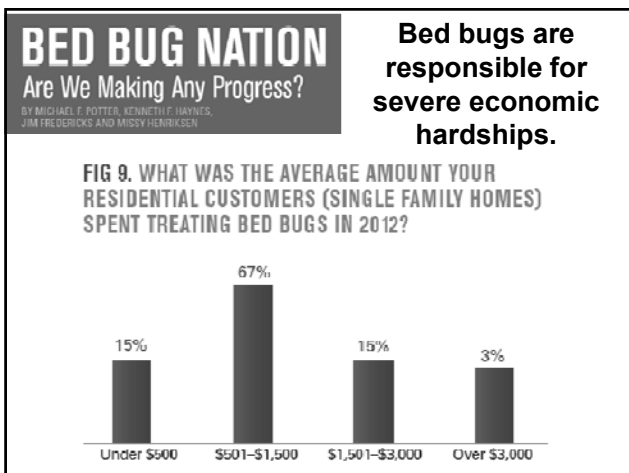
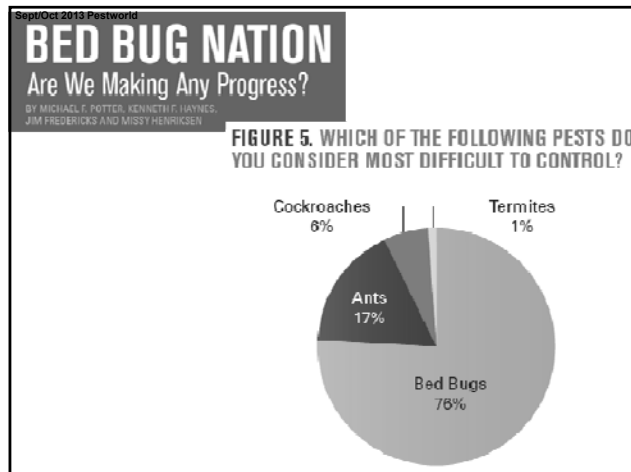
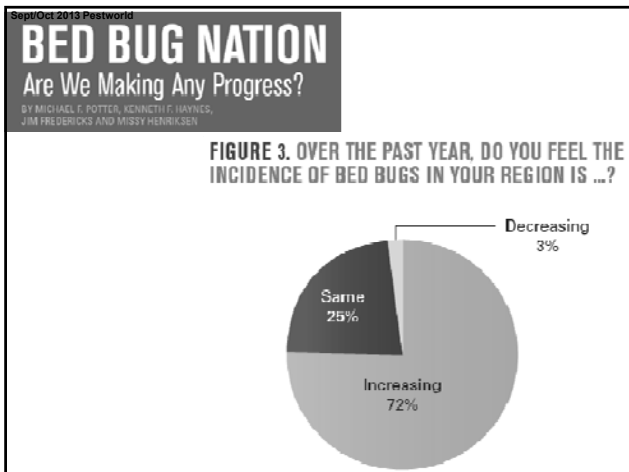
BED BUG NATION

Are We Making Any Progress?

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

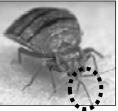
FIGURE 2. HAVE YOU TREATED OR BEEN ASKED TO TREAT FOR BED BUGS WITHIN THE PAST YEAR?







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!



*wheelchair

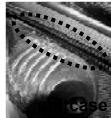


*walker

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



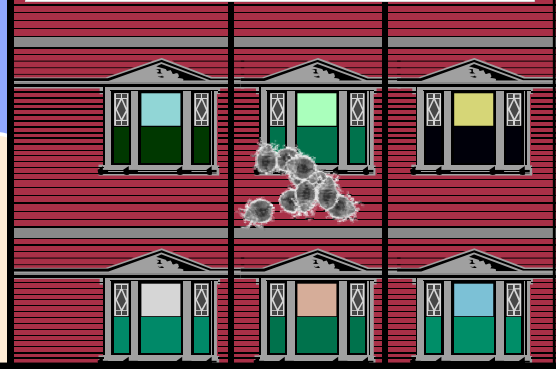
shoe tread



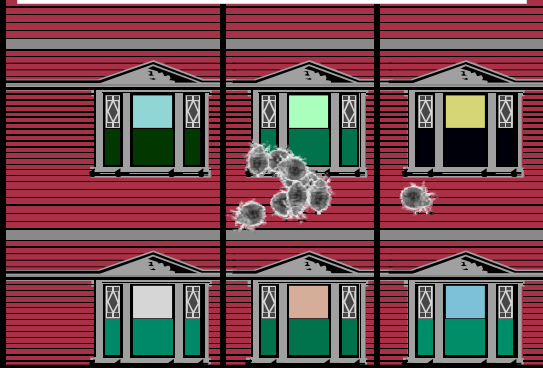
case

*Photos courtesy of General Pest Control Co.

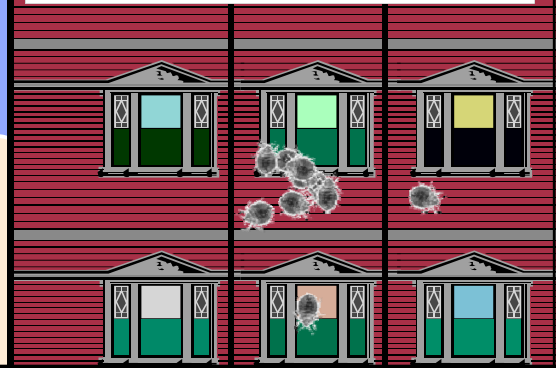
In multi-family housing, bed bugs readily spread to units that are adjacent, below, and above the infested unit.

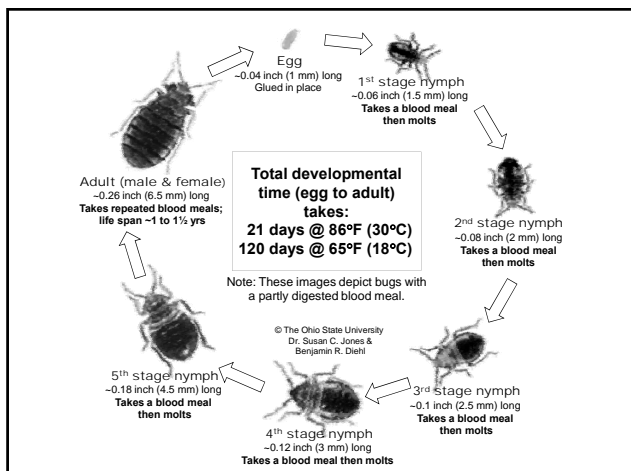
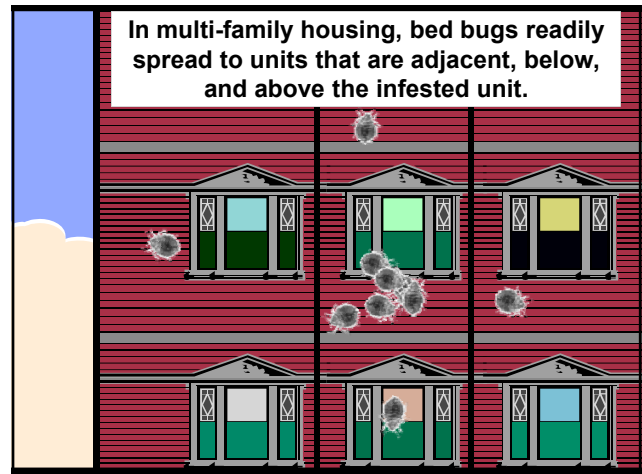
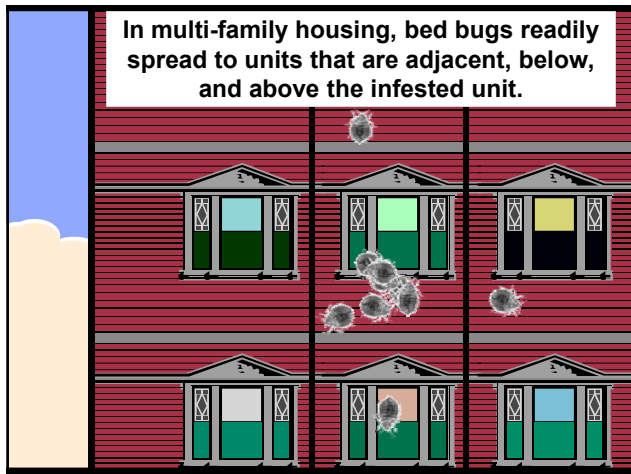


In multi-family housing, bed bugs readily spread to units that are adjacent, below, and above the infested unit.



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) are concerned by the growing public health threat posed by bed bugs (Cimex lectularius) in residential settings across the United States.

Bed bugs (Cimex) have been common in U.S. history, although incidence and prevalence dropped dramatically during the mid-20th century. In the United States, a rise in their numbers has been associated with an increasing reliance on the use of bed bugs. Though the exact cause is not known, experts suspect that the resurgence is associated with increased travel, the use of bed bugs in hotels, greater international and domestic travel, the use of luggage, and the increasing decline or elimination of effective vector control programs at state and local public health agencies.

In recent years, public health agencies across the country have been overwhelmed by requests to control bed bugs. As a result, public health professionals, together with pest management professionals, housing authorities and private citizens, will develop and implement control strategies for the management and control of bed bugs and prevent 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 source of significant public health concern. Bed bugs do have a capacity to blood-sucking, which can cause allergic reactions, bed bug bites, and bed bug bites. Bed bugs are not believed to transmit disease. Other ectoparasites, such as head lice (Phthirus pubis) and scabies (Sarcoptes scabiei), are known to transmit disease. Differences in the biology of similar species of pests, such as bed bugs, and the use of bed bugs in hotels, suggest the ability of pests to transmit disease.



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.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)

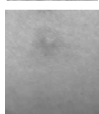
Wide range of skin lesions (with or without severe itching [pruritus]):



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



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

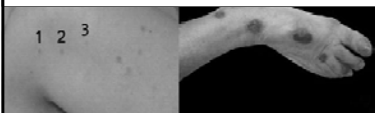


- Plaques
- a broad papule or confluence of papules (≥1 cm)
- Prominent wheals
- rounded or flattened pale red papules or plaques that disappear within 24-48 hrs

- Bullae (fluid-filled blisters)

Clinical Manifestations of Bed Bug Bites (Cimicosis)

common distribution of skin lesions



atypical bullous lesions



urticaria



BMJ

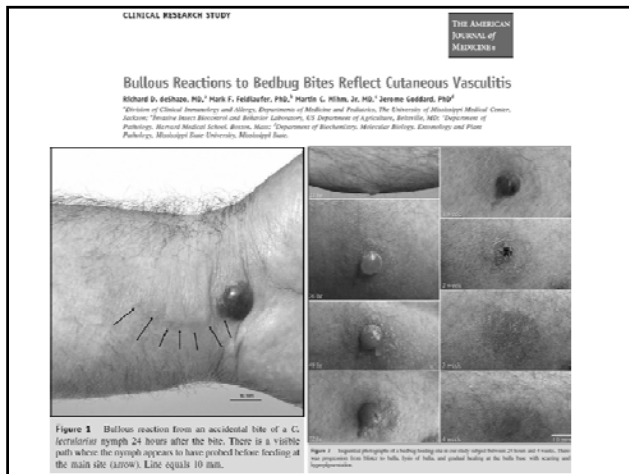
CLINICAL REVIEW

Bed bug infestation

Cimex lectularius: dermatitis? / Cimex lectularius: dermatitis? / Cimex lectularius: dermatitis?

BMJ 2007;335:e1000. doi:10.1136/bmj.e1000

- Typically on exposed skin
- Often in groups or rows



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. 2, May, 1962.

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
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India

CMAJ

PRACTICE

Canadian Medical Association Journal 181: 287-88.

Severe anemia from bedbugs

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

Previously published at www.cmaj.ca on Aug. 31, 2009.

Canada

Anemia From Bed Bug Bites

Parasitol Res (2012) 110:2575-2579
DOI 10.1007/s00436-011-3775-6

SHORT COMMUNICATION

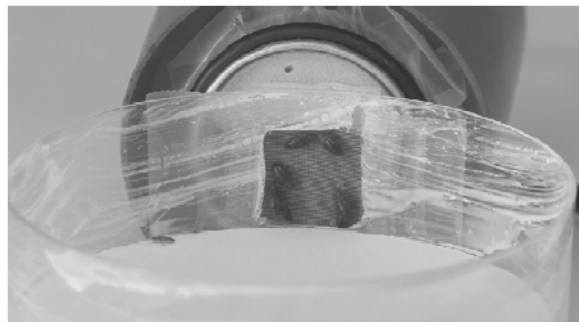
Austria

Bed bugs can cause severe anaemia in adults

Martin Paulke-Korinek · Marion Szöll · Hermann Lafert · Herbert Auer · Christoph Wenisch

A single blood meal of an adult bed bug may have a volume of up to 7 mm³. 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.”

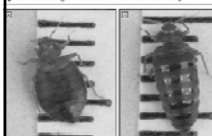


2009. JAMA 301(13): 1358-1366.

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

Jerome Goddard, 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,* Richard deShazo, MD*

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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 (≥20) 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.

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

Case Reports

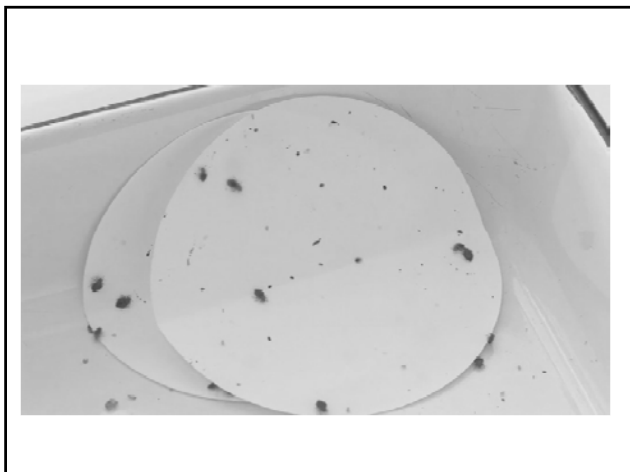
Psychiatric Consequences of Actual Versus Feared and Perceived Bed Bug Infestations: A Case Series Examining a Current Epidemic

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.^{1,2} 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.^{1,2}

Bed bugs present unique difficulties relative to other common pests that are active at night, such as roaches and crickets. 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.	(%)
Work related ^a		
Yes	11	(37)
Pesticide applicator certification		
Certified applicator	2	(2)
Uncertified/unsupervised applicator	15	(14)
Home occupant not certified to apply pesticides	15	(20)
Inadequate ventilation of applicator	15	(20)

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

Contributing factor	Total	
	No.	(%)
One or more contributing factors identified ^a	56	(100)
Excessive application	10	(18)
Failure to wash or change pesticide-treated bedding	9	(16)
Notification lacking/ineffective	8	(14)
Failure to vacate premises	5	(9)
Spillover of liquid or dust	4	(7)
Inadequate ventilation ^b	3	(5)
Early reentry	2	(4)
Mixing incompatible chemicals	2	(4)
Improper storage	1	(2)
Label violation not otherwise specified ^c	15	(27)
No LULU, follow-up person still ill	2	(4)



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

- “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)

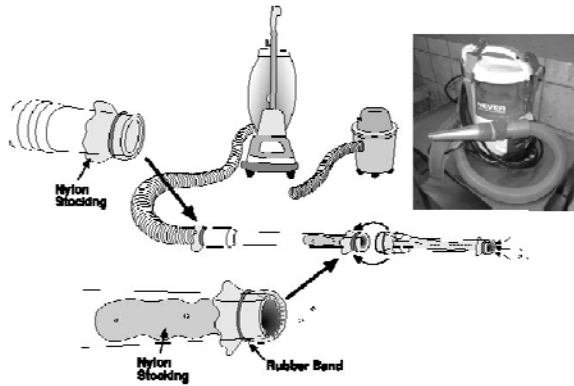
Some measures to help reduce the number of bed bugs:

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.



Vacuuming 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 ...