



# **PESTS AND INTEGRATED PEST MANAGEMENT FOR SCHOOLS**

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# Common Pests in Schools

## Vertebrates

- Rodents
  - Rats
  - House mice
  - Deer mice
- Bats
- Raccoons



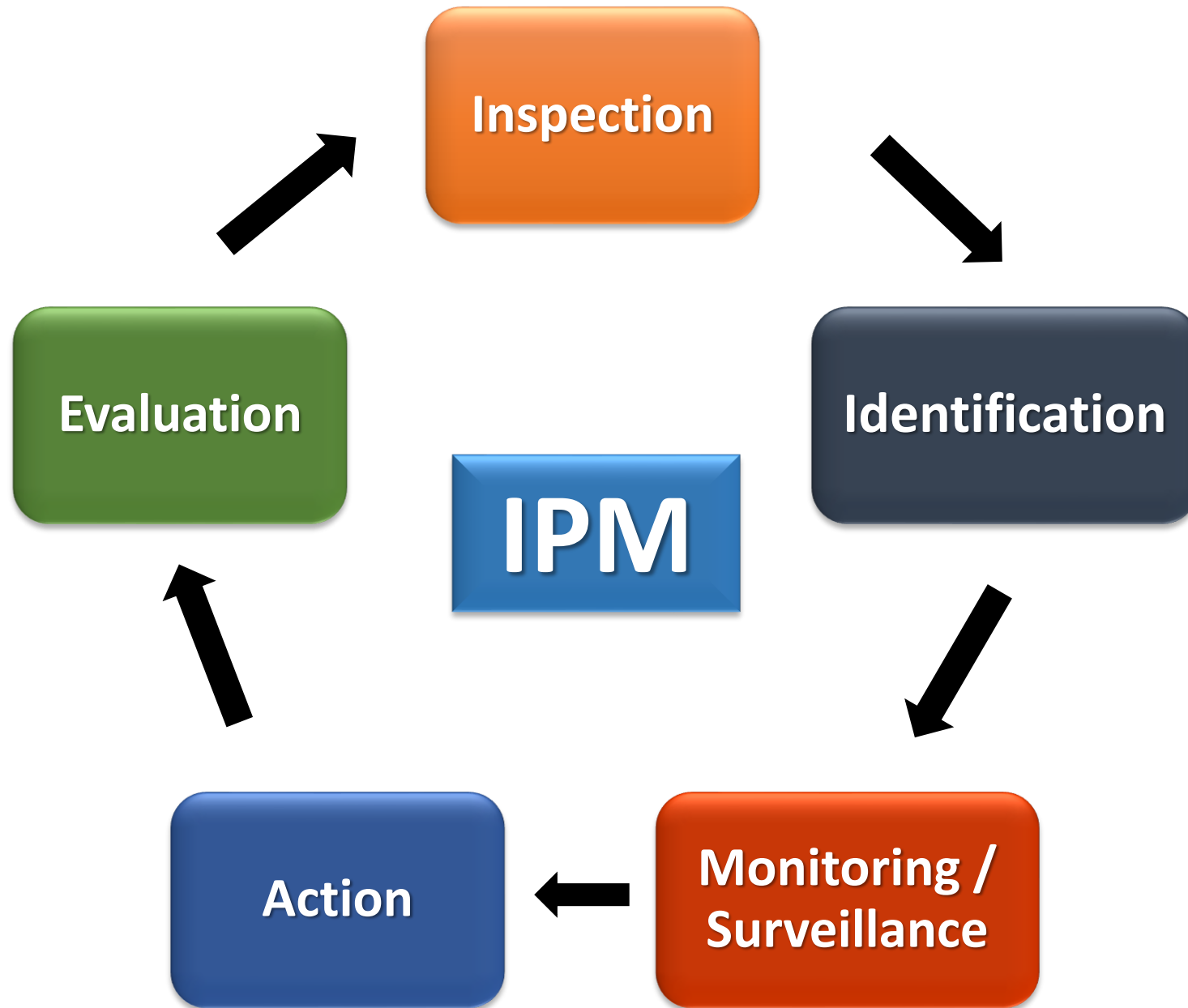
## Invertebrates

- Spiders
- Stinging Insects
- Head Lice
- Bed bugs
- Ants
- Food pests
- Flies



# Integrated Pest Management

- An environmentally sound approach to pest control.
- Inspection based.
- Uses current, comprehensive information on life cycles of pests and their interaction with the environment.
- Combined with available pest control methods, used to manage pest damage by most economical means, and with the least possible hazard to people, property, and environment.
- Success depends on the ability to fully understand the pest population's behavior and its interaction with its environment.

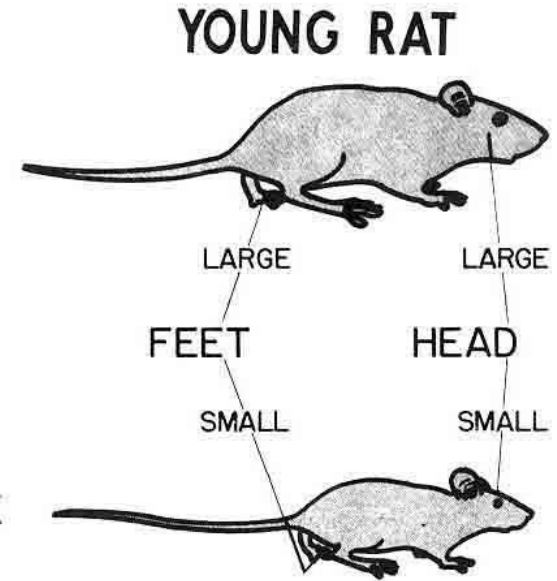
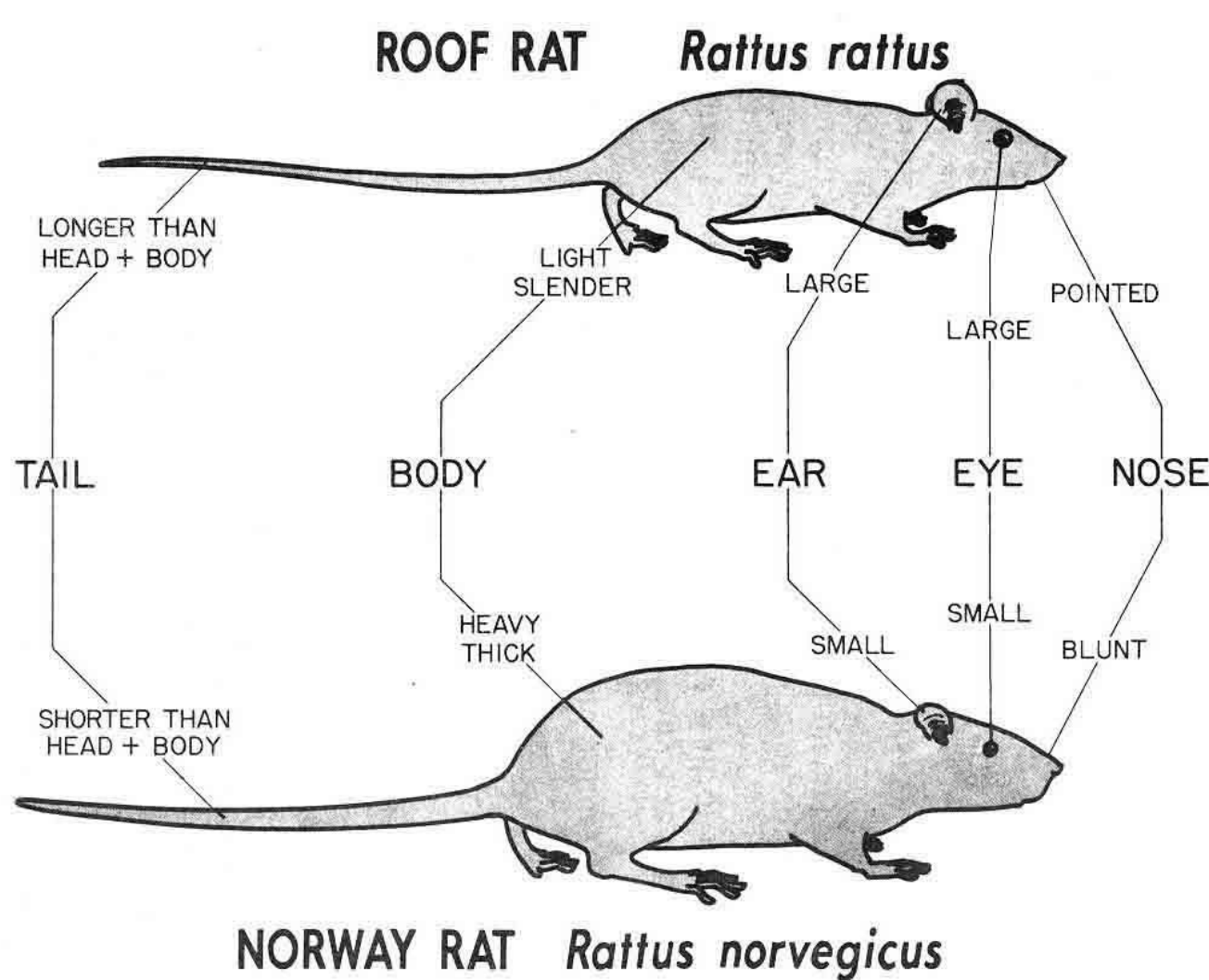


# Rodents

- Roof Rat (*Rattus rattus*)
- Norway Rat (*Rattus norvegicus*)
- House Mouse (*Mus musculus*)
- Deer Mice (*Peromyscus species*)



# FIELD IDENTIFICATION OF DOMESTIC RODENTS



**HOUSE MOUSE**  
*Mus musculus*

PREPARED BY  
 U.S. Department of  
 HEALTH, EDUCATION, AND WELFARE  
 Public Health Service  
 Communicable Disease Center  
 Atlanta, Georgia



# Deer Mouse

*(Peromyscus species)*



Top of tail  
has dark  
strip of hair

Large  
bulging  
eyes

White underbelly and throat

# House Mouse vs Immature Deer Mouse



Photo courtesy of Jim Harrison, USAPHC



# Norway rat

*Rattus norvegicus*

- Brown rat, Wharf rat
- Mongolian origins
- Home Range = 90'-450'
- Food preferences: omnivores
- Burrower



# Roof rat

*Rattus rattus*

- Black rat, Ship rat
- SE Asia origins
- Home Range = 100'-300'
- Food preferences: nuts, fruits, seeds, vegetables, slugs, snails
- Climber





# House Mouse

*Mus musculus*

- Caspian Sea area origins
- Home range – 30’-50’
- Natural food = grass seeds, bird seed
  - Loves German cockroaches
- Gravitates towards warmth

# Zoonoses associated with Commensal Rodents

Disease	Vector – Pathogen
Plague	Fleas – <i>Yersinia pestis</i>
Rat Bite Fever	<i>Streptobacillus moniliformis</i> ; <i>Spirillum minus</i>
Murine typhus	Fleas - <i>Rickettsia typhi</i> and <i>R. felis</i>
Leptospirosis	<i>Leptospira interrogans</i> serovar <i>icterohaemorrhagiae</i>
Toxoplasmosis	<i>Toxoplasma gondii</i>
Angiostrongylosis	<i>Angiostrongylus cantonensis</i>
Lymphocytic Choriomeningitis	<i>Arenavirus</i>
Rickettsialpox	House Mouse mite – <i>Rickettsia akari</i>
Salmonellosis	<i>Salmonella</i> spp.



## Deer Mouse

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- Native to North America
- Home range:
  - 0.75 (females) – 1.5 (males) acres
- Food preferences:
  - Omnivorous; seeds, nuts, fruits, and insects
- Reservoir for Hantavirus

# Rodents – Prevention & Control

- Prevent rodents from colonizing in and around homes and workplaces
- Safe cleanup of rodent waste and nesting materials
- Use proper control methods

Seal Up!  
Trap Up!  
Clean Up!

Signs of a mouse infestation



# Clean Up

***DO NOT SWEEP, DUST or VACUUM!***

1. **Wear protective equipment** (coveralls, rubber boots, gloves, goggles, appropriate respiratory protection)
2. Air out the contaminated area
3. Don't stir-up and breath dust
4. Spray droppings, dead mouse, nesting material with disinfectant or bleach-water mixture; let soak
5. Wipe up with paper towels or mop up
6. Dispose of waste & dead animals in plastic bag
7. Mop or sponge the area
8. Wash gloved hands before disposing
9. Decontaminate or dispose of protective coverings
10. Wash hands, shower

1 part bleach  
+  
9 parts water





# Disposal of Rodent Contaminated Supplies and Equipment

- Put on protective clothing and equipment
- Spray contamination with disinfectant
- Wait 30 - 60 minutes
- Place sprayed decontaminated material in a plastic bag - seal the bag
- Place the bag in a dumpster

# Harder to Clean Items

Follow basic procedures as discussed and for contaminated items:

- Carpets, rugs, upholstered furniture
  - *Steam clean with disinfectant, hot water*
- Clothes, bedding
  - *Wash in hot water and detergent, dryer heat high*
- Books, paper, and other things that can't get wet
  - *Expose to sunlight or isolate in non-infested areas to allow virus to "die out"*





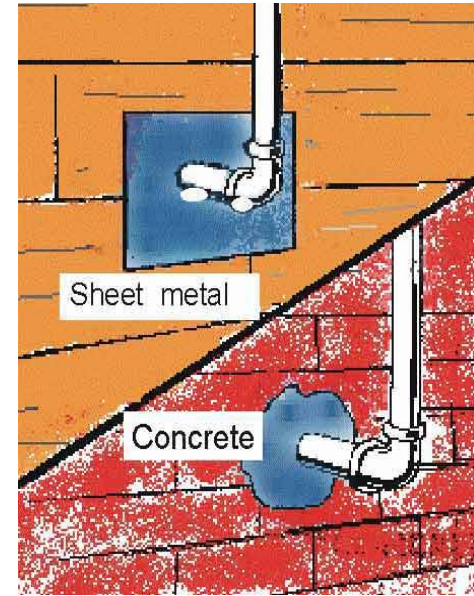
# How They Get In



$\frac{1}{4}'' \times \frac{1}{2}''$



# Prevention - Deterrence





Controlling Rodents  
Outside

Encourage natural predators

# Rodent Control

- Mouse snap traps - read instructions
- Use chunky peanut butter (mixed with oats) as bait
- Place traps where you have mice evidence
- Put end of trap against wall to form “T”
- Concentrate traps
- Keep away from pets & children
- Keep track of placement, check regularly
- Clean up and dispose of trapped rodents properly



Baiting and setting mouse traps

# Rodent Control

- Poison baits can be useful for serious infestations
  - Follow instructions
  - Keep out of reach of pets & children
  - Check often and refill as needed
  - Acknowledge problems they can cause
- Glue traps and live traps are not recommended
  - Mice get scared, urinate, move around, potentially stirring virus into the air



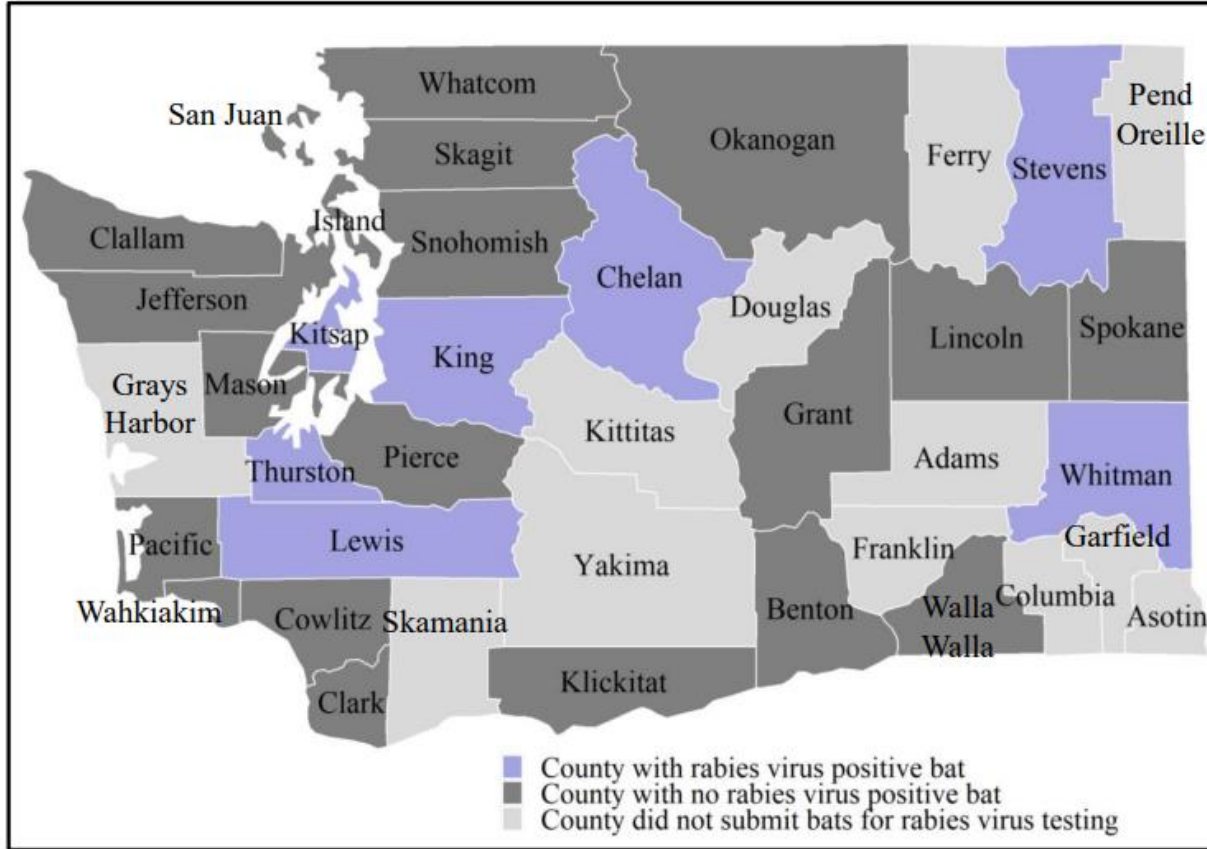
# Bats

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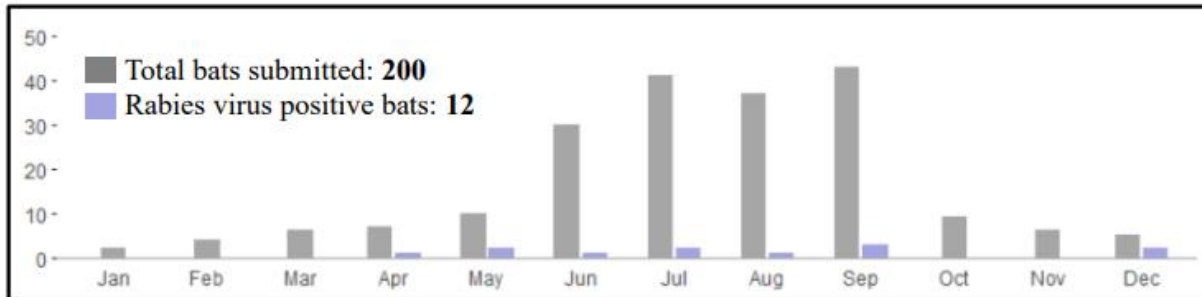




## Bats Submitted for Rabies Virus Testing by County of Submission — Washington State, 2021



County	No. Positive Bats
Chelan	1
King	6
Kitsap	1
Lewis	1
Stevens	1
Thurston	1
Whitman	1



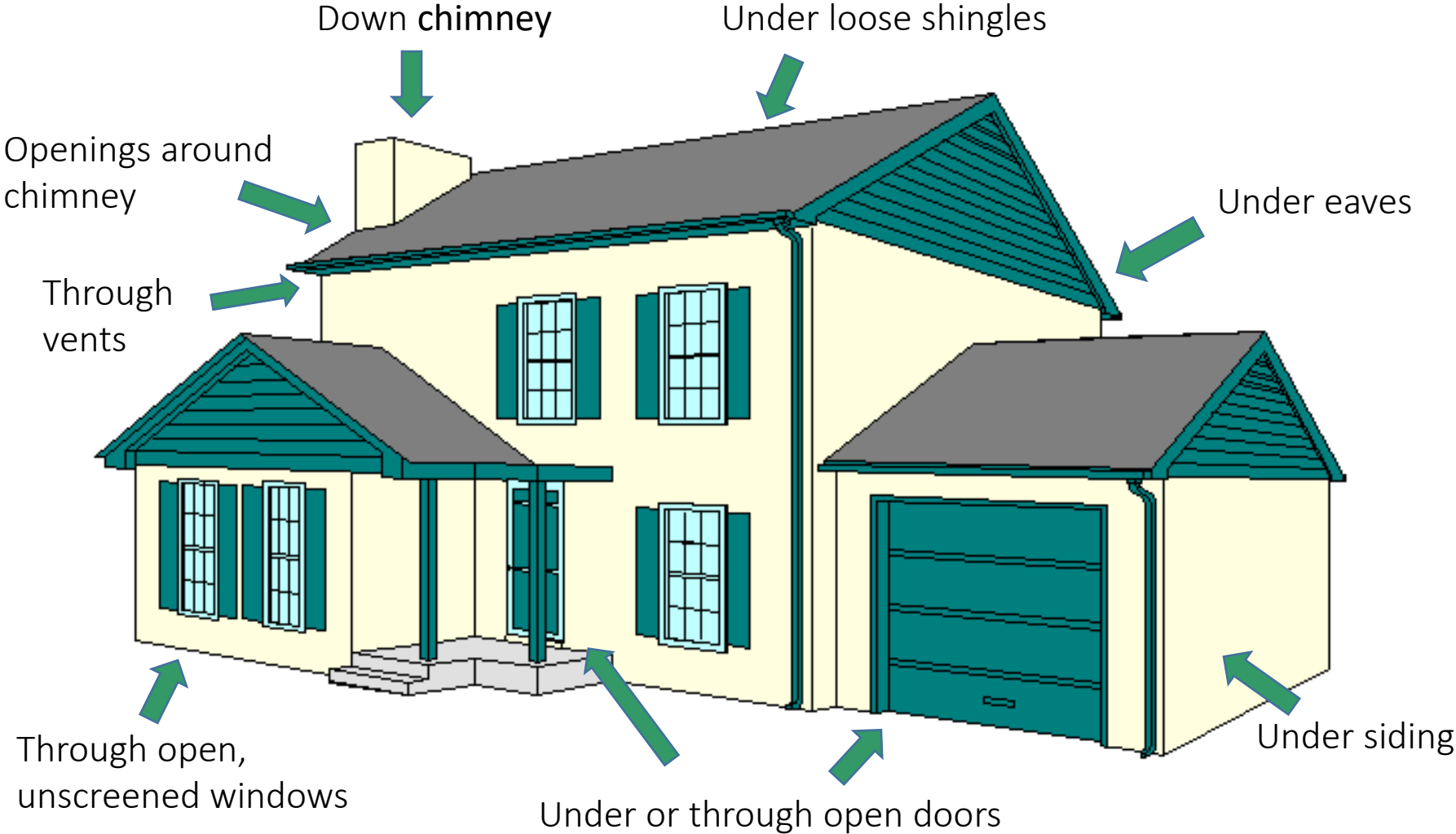
# Bats with rabies

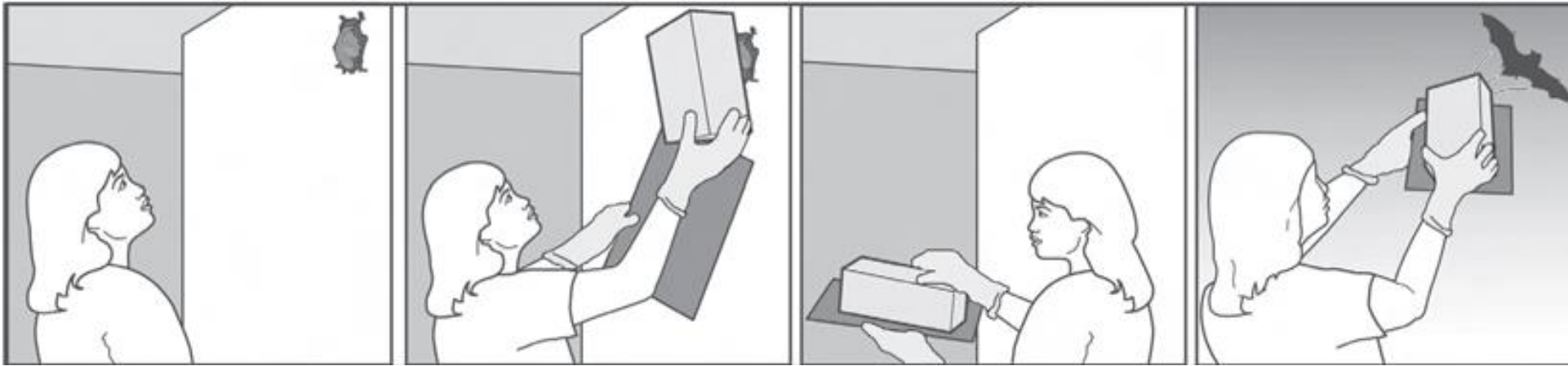
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- May appear injured
- May be found flapping or dead on ground
- May fly during the day
- May be found in pets mouth
- Cats are the most commonly affected domestic animal.



# Common Bat Entry Points





## To Capture a Bat:

- When the bat lands, approach it slowly, **while wearing leather gloves**, and place the box or coffee can over it.
- Slide the cardboard under the container to trap the bat inside.

If no one exposed – release bat outside.

If person was exposed:

- Tape the cardboard to the container securely, and punch small holes in the cardboard, allowing the bat to breathe.
- ***Contact your Local Health Dept.*** to make arrangements for rabies testing.

# Rabies testing in WA

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- Call local public health
- Bat must be shipped rapidly and kept cold to prevent deterioration.
- Testing at WA Public Health Lab
- 300-500 animals tested annually
  - ~50% Domestic / 50% wild





Raccoons

# Raccoon Latrines — Source for Raccoon Roundworm



Roussere et al., "Raccoon Roundworm Eggs near Homes and Risk for Larva Migrants Disease, California Communities," [Emerging Infectious Disease](#), 2003 Dec

# Raccoon Latrines – Clean Up

- Remove feces & contaminated material – burn, bury, or send to landfill
- Avoid getting feces on hands and clothes
- Use PPE
- Wash hands immediately afterward with soap & water.





# Raccoons - Prevention



- Discourage contact with raccoons
- Do not leave food out for raccoons
- Keep food in raccoon-proof containers
- Cover sand boxes when not in use
- Clean up brush around property



# Spiders

# Western Black Widow

- Found in woodpiles, wall crevices, crawl spaces, exterior gas & water meters
- Nonaggressive
- Symptoms occur 30 min–few hours of bite
- Local bite site care – thorough cleansing, ice pack, then go see doctor



Western black widow spider

# False Black Widow

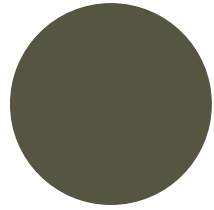
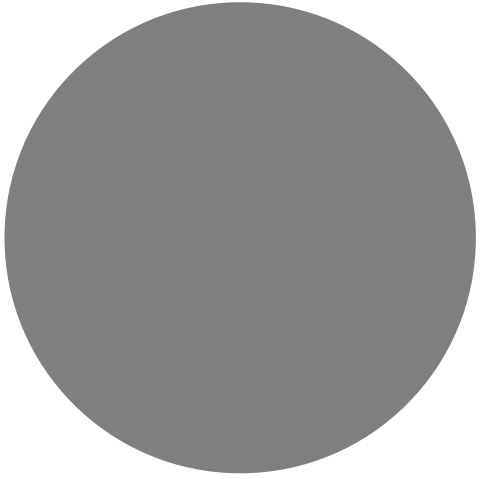
- Found in houses and garages
- Shaped like Black Widow; glossy black with NO red hour-glass shape on abdomen
- Bites – pain and systemic effects similar to, but milder than black widow bites
- Distribution worldwide



False Widow (*Steatoda grossa*)

# Spider Control Strategies

- Use gloves and clothing that covers skin when working in crawl spaces and similar locations, retrieving firewood, etc.
- Screen basement and ground-floor windows
- Install insulation strips under doors
- Spiders are beneficial - Carefully trap spiders and release outdoors far from buildings.



Stinging Insects



# Bees

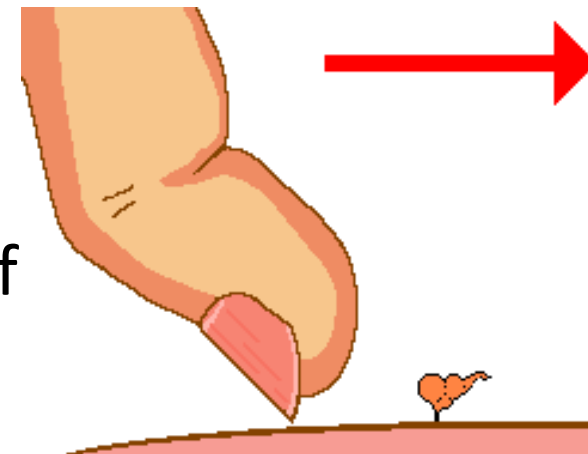
- Honey bees, Bumble bees, Orchard Mason bees
- Non-aggressive if left alone
  - **Critically** important pollinators for food crops
- Attracted to sweet liquids
  - e.g. regular Coke or Pepsi
- If stung by a honey bee, scrape stinger out of sting site.



Bumble bee



Honey bee



Removing a honey bee stinger



# Wasps and Hornets

- Beneficial insects – eat insects that damage shade trees and crops and house flies
- Nests can be in trees, on buildings or under-ground, depending on species
- Attracted to food at picnics or in garbage cans

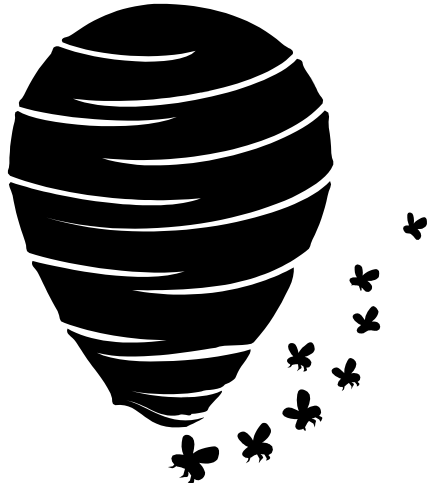


# Wasps and Hornets



- Aerial nests can be sprayed with aerosol
- Underground nests – use registered hornet & wasp spray; Direct spray into hole after dark
- In wall voids – call a professional

# Stinging Insects – Bees, Wasps, Hornets



- Avoid fast movements if they're in the vicinity.
- Don't wear strong smelling cologne or perfume to work.
- Avoid wearing brightly colored clothing (esp. yellow, orange and red).
- Wear white, green or bright brown.
- No teasing . . .

# Wasps and Hornets

## Safety Precautions

- Cover yourself with thick clothing
  - head, face, neck, hands
- Wear glasses to protect eyes
- Spray or remove aerial nests during the coolest part of evening; on a cool day if possible
- Carefully put pesticide into the entrance hole of ground nests after dark (they may be attracted to the light of your flashlight)



Hornet nest

FEAR OF CORONA IS ON THE DECLINE

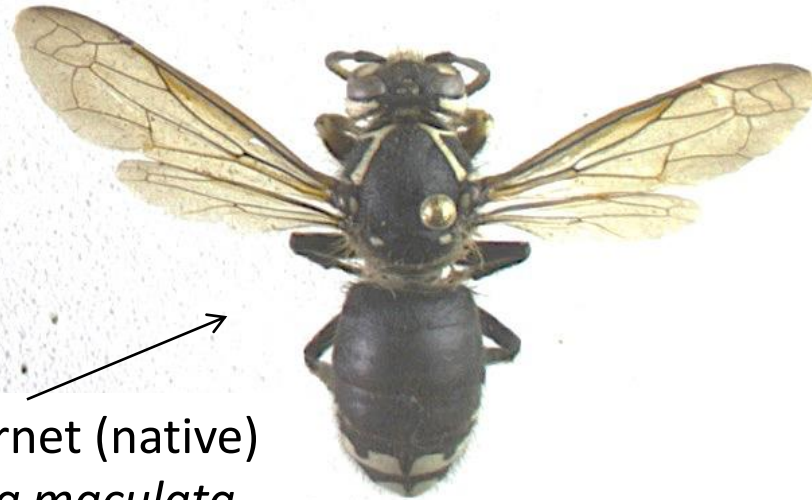


RELEASE THE MURDER HORNETS

Asian giant hornet (exotic)  
*Vespa mandarinia*



bald-faced hornet (native)  
*Dolichovespula maculata*



# Northern Giant Hornet

Only found in Whatcom County. No detections in 2022.

- Venom impacts are similar to other Hymenoptera - but can be a little worse
  - Localized tissue necrosis and massive pain are the most likely outcomes of a sting
- Anaphylactic shock is always a risk from stinging Hymenoptera
- *V. mandarinia* delivers large doses, but typically sting only when handled, defending the nest, or defending a hive they are attacking
- Treat stings with cold to slow venom spread, and seek medical attention if you are stung multiple times or have signs of an allergic reaction



# Head Lice



# Head Lice

- Small parasitic insects adapted to living mainly on the scalp and neck hairs of their human host.
- Do not respect socio-economic class distinctions.
- Presence does not connote a lack of hygiene or sanitation.
- Mainly acquired by direct head-to-head contact with an infested person's hair, but may infrequently be transferred with shared combs, hats and other hair accessories.



Louse



Images to assist in the identification of head lice and their eggs.

<http://www.hsph.harvard.edu/headlice.html>



Adult female louse  
on nit comb



Viable egg  
on hair  
~2 days old



Viable egg  
~1 day before hatching

c 2000 President and Fellows of Harvard College



Empty egg  
(hatched)



Dead egg  
(>2 weeks old)



'Pseudo-nit'  
(Debris often confused  
as eggs)

# Head Lice – Control & Prevention

Once a head lice infestation is confirmed:

1. Treat with an approved lice control treatment, carefully following treatment directions
2. After treatment, comb the hair with an effective, metal, lice removal comb to remove the nits.
3. Get rid of eggs in the sink, toilet, or garbage. Vacuum around the area where you were combing out eggs. Both people should change their clothes afterwards.
4. Comb, using the lice comb daily for seven days, and until you no longer find any lice or eggs.
5. Most products recommend retreating after 7-10 days. Repeat above steps.



**Bed Bugs**



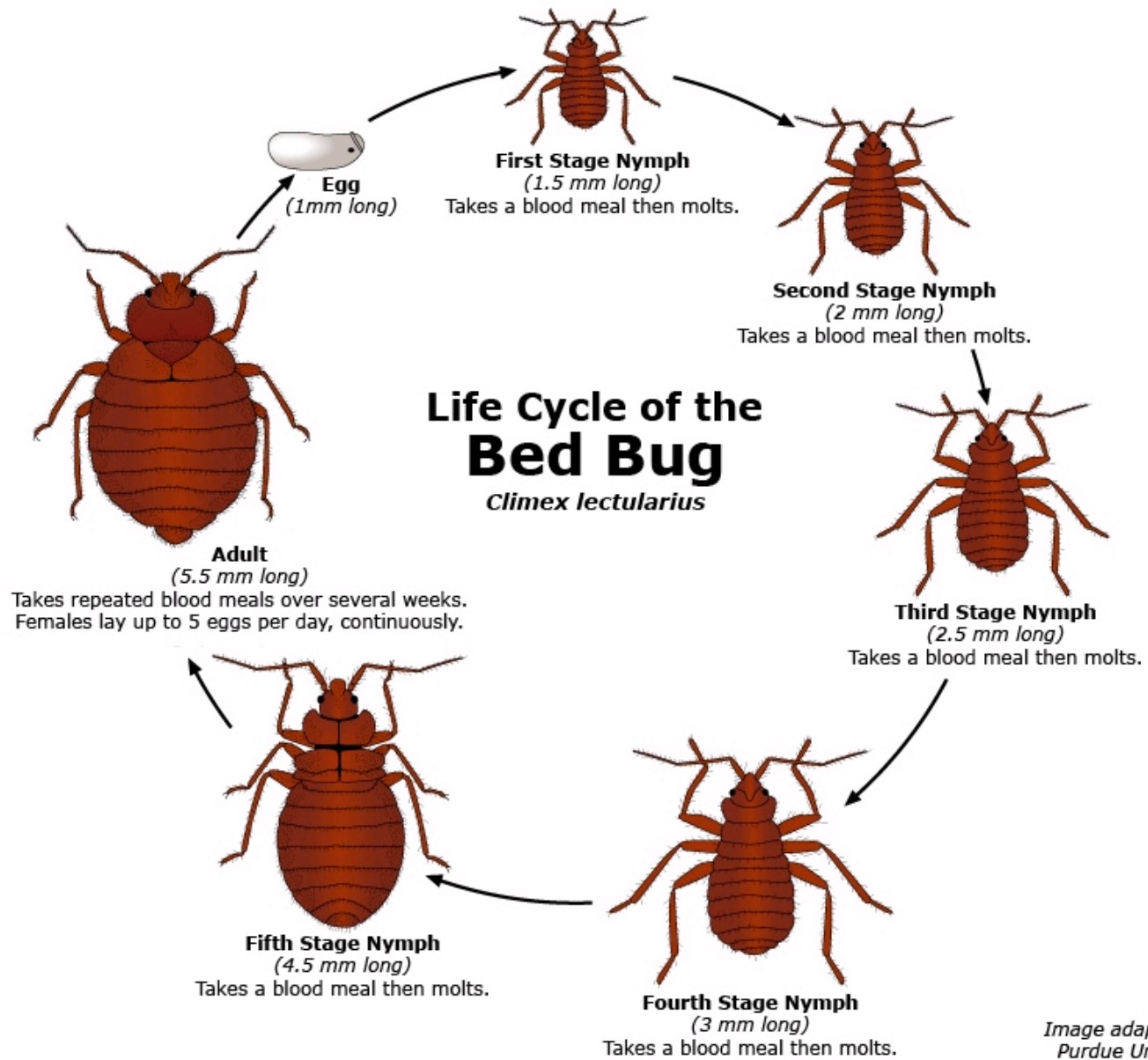


Image adapted from  
Purdue University

# Are Bed Bugs A Public Health Issue?

- Found naturally infected w/ >28 human pathogens
  - Never proven to transmit any human disease
- Allergic reaction to bites (mild to severe)
- Secondary skin infections from scratching bites
- Mental Health issues
  - Anxiety, insomnia, systemic reactions
  - Serious social stigma to “having” an infestation



Bed bugs - 8 days post-bite

Following first-time exposure to 20-30 bed bugs held in rearing container

Bed bugs - 14 days post-bite



Bed bugs - 1 month post-bite







# Bed Bug Action Plan for Schools

*Dini M. Miller, Ph.D., Department of Entomology, Virginia Tech*

- Select an experienced Pest Management Company before you have bed bugs;
- Bed bug ID training for all administrators, faculty, and staff;
- Alert parents to the national bed bug problem;
- Implement bed bug prevention methods;
- Develop a Code of Practice for when a bed bug is found.



<https://www.vdacs.virginia.gov/pdf/bb-schools1.pdf>

### Site Directory

#### [Zoonotic Diseases](#)

- [About the program](#)
- [Contacts](#)

#### Learn more about

- [Office of Environmental Health, Safety, and Toxicology](#)
- [Other Environmental Health Programs & Services](#)



## Bed Bugs

[Printer friendly version](#) (PDF 47KB)

### What are bed bugs?

Bed bugs are small, flat insects that feed on our blood, typically at night, while we are sleeping. Adult bed bugs are about 1/4 of an inch long, have flat, rusty-red-colored oval bodies, and look like an apple seed. They feed for about 3-10 minutes and their bodies swell and become bright red. During the [bed bug life cycle](#), a female can lay 200-400 eggs depending on food supply and temperature. Bed bugs don't fly, but can quickly walk across floors, walls, and other surfaces.

### Can I get a disease from bed bugs?

No, there are no known cases of infectious disease transmitted by bed bug bites. However, some people are more sensitive to the bites and develop itchy, red welts. Scratching the bites can lead to infection. Bed bugs may also affect a person's mental health. Anxiety, insomnia, and irritability have been reported in some people.

### How do I prevent bed bugs from entering my home?

People often bring bed bugs into their homes via infested luggage, furniture, bedding, or clothing. Bed bugs can hitch a ride on items purchased second-hand, or from furniture and bedding that is delivered to your home. Bed bugs may also travel between



### Signs of Bed Bugs

Red, itchy bites on skin noticed after sleeping.

Small rusty-red and black spots on mattress, pillows, and bed linens.

Sweet, musty odor.

### If You Find Bed Bugs

Tenants - Notify your landlord immediately.

Landlords - Hire a licensed and

Ants



# Ants – Surveillance & Treatment

- Monitor for ants near attractive food sources or moist areas.
- Household ants feed on sugar, syrup, honey, fruit juice, fats, and meat.
- Check indoors and outdoors for holes or cracks in foundations or walls that provide entry points to buildings.
- Caulk cracks & crevices around foundations and other sites that provide entry from outside.
- If ants are found in potted plants, remove the containers from the building, then place the pots for 20 or more minutes in a solution of insecticidal soap and water at a rate of 1 to 2 tablespoons of insecticidal soap per quart of water.

# Ants - Prevention

- Store attractive food items such as sugar, syrup, honey, and pet food in closed containers that have been washed to remove residues from outer surfaces.
- Rinse out empty soft drink containers or remove them from the building.
- Thoroughly clean up grease and spills.
- Remove garbage from buildings daily and change liners frequently.



## Food Pests

- Promptly discard any contaminated human or animal food products.
- Clean the storage area and examine remaining products for infestation.
- Store grains, flours, and pet food in tightly sealed containers.
- In areas where moths are flying, traps using pheromones can be used to monitor the pest population and trap Indian meal moth adults.



# Flies

- Sanitation
- Sticky traps
- Eliminate breeding areas
- Place dry garbage and trash in plastic garbage bags, seal up, and place in garbage receptacles.
- All garbage receptacles should be located as far from building entrance as possible.
- Screen windows
- Use air doors where food is brought into kitchens from delivery trucks.

# Resources

- Washington State Department of Health  
<https://doh.wa.gov/community-and-environment/pests>
- IPM in Schools  
<https://schoolipm.wsu.edu/>
- Head Lice  
<https://www.tn.gov/content/dam/tn/health/documents/healthy-places/healthy-schools/TN-Lice-Manual-12-29-21.pdf>
- Bat Conservation International
  - [www.batcon.org](http://www.batcon.org)
- Bats Northwest
  - [www.batsnorthwest.org](http://www.batsnorthwest.org)
- Insects in the City blog (Texas A&M University)  
<https://citybugs.tamu.edu/>





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