




## Chapter 8

### Rodents and Rodent Control

Texas A&M AgriLife Extension Service  
Public Health License Holders Course

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- Introduction to rodents
- Biology of House Mouse
- Biology of Roof Rat
- Biology of Norway Rat
- Special considerations in sensitive environments
- EPA Risk Mitigation details

### Today's Topic

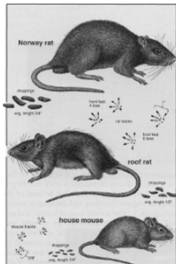
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- Commensalism – a relationship between two organisms in which one obtains food or other benefits from the other (without direct harm or benefiting the other)

### Commensal rodents

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### The most important commensal rodents

- House mouse
- Norway rat (brown rat)
- Roof rat (black rat)

FIGURE 15.1. The commensal rodents: Nature's most adaptable mammals. (Pfeiffer)



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- Ability to survive in a wide range of habitats
- Relatively small body size
- Secretive
- High reproductive potential
- Opportunistic feeder
- Compulsive explorer
- Variable behavior
- Human tolerance

### Why are rodents so successful?

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### Harmful side of rodents


- Contaminate food areas
- Steal and contaminate food
- Chewing damage
- Burrowing activities
- Rat bites
- Odors
- Generates fear and repugnance
- Transmit disease

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Disease transmission by rodents



House Mouse  
.5-1oz  
5.5-7.5" long



Norway Rat  
7-18oz  
13-18" long

- Implicated in 63 different human diseases NOT rabies
- Food poisoning may be greatest threat
- Disease threat from urine and droppings not well studied

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### Two most prevalent diseases in TX

#### Flea-borne typhus

- Murine or endemic typhus, is a rickettsial disease caused by the organism *Rickettsia typhi*
- Rats and their fleas are the natural reservoirs for flea-borne typhus
  - Rats and their fleas are the natural reservoirs (animals that both maintain and transmit the disease organism) for flea-borne typhus
- People get flea-borne typhus from an infected flea.
  - Most fleas defecate while biting; the feces of infected fleas contain the rickettsial organism.
  - The rickettsiae enter the body through the bite wound or from a person scratching the bite area

#### Hantavirus pulmonary syndrome

- Hantavirus pulmonary syndrome (HPS) is an infectious disease that can cause death. It is spread to people by rodents, such as rats and mice.
- In North America, the deer mouse, white-footed mouse, rice rat, and cotton rat are the known carriers of this virus.
- Transmission to humans is typically through rodent droppings and urine when it becomes disturbed.

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### Symptoms of these diseases

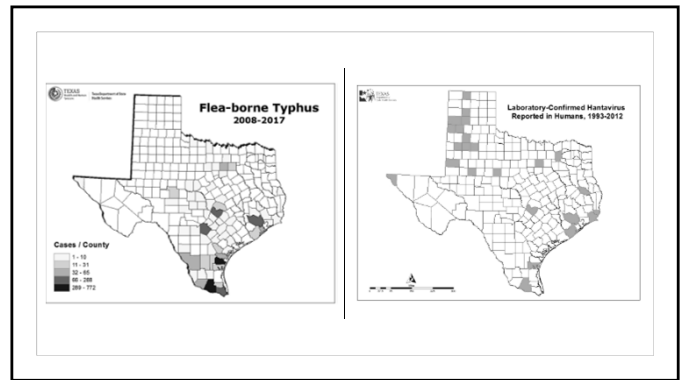
#### Flea-borne typhus

- Incubation period for flea-borne typhus is 6 to 14 days.
- Symptoms of the disease include:
  - headache, fever, nausea, and body aches.
  - 5 - 6 days after the initial symptoms, you may get a rash that starts on the trunk of the body and spreads to arms and legs.
  - Left untreated, the disease may last for several months.
  - Tests can be done to detect flea-borne typhus.



#### Hantavirus pulmonary syndrome

- Incubation time is 1 to 5 weeks before they will feel sick
  - Fever
  - Severe muscle aches
  - Fatigue
- After a few days they will have a hard time breathing. Sometimes people will have headaches, dizziness, chills, nausea, vomiting, diarrhea, and stomach pain. Usually, people do not have a runny nose, sore throat, or a rash

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### Rodent's teeth grow continually

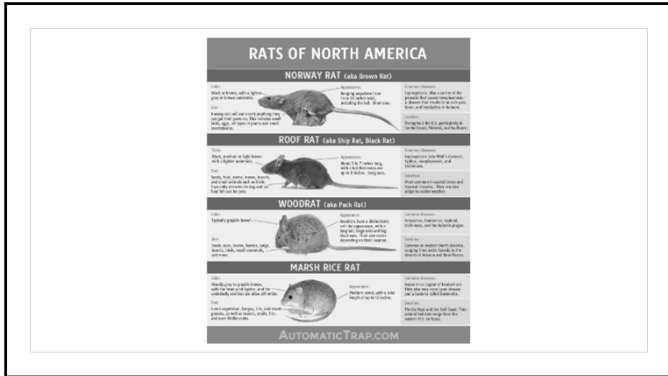
- 2% of daily activity is gnawing
- teeth grow at rate of 0.4 mm per day
- tooth hardness index is greater than iron
- up to 7,000 PSI biting pressure

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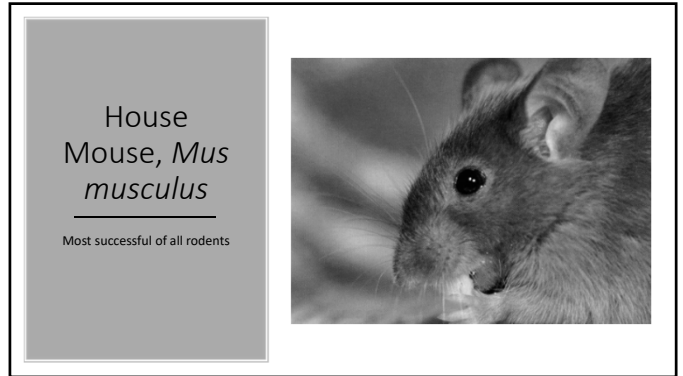
### Other rodent species of importance

Cotton Rat	Rice Rat	Deer Mouse	White Footed Mouse
			
			

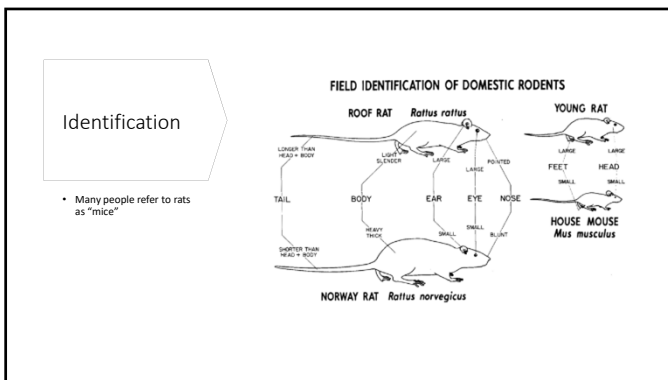
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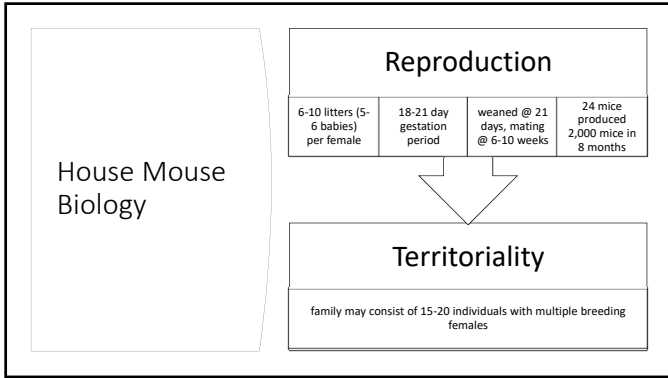
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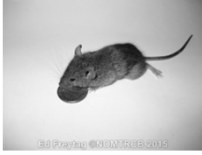

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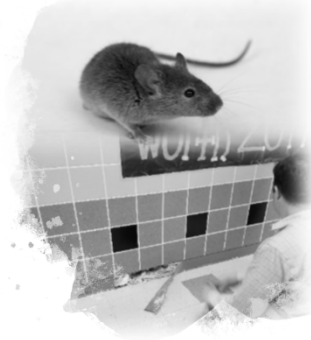



### Biology of house mouse (cont.)

- Thigmotactic
  - vibrissae
  - rely on touch to navigate
- Curious but tends to avoid lighted areas
- Requires little water
- Fast
  - speeds up to 12 ft per second
  - jump over obstacles

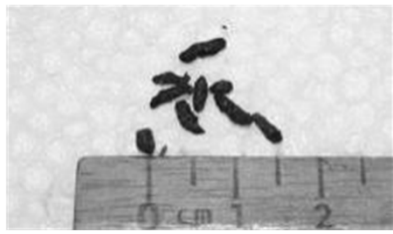
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### Biology of house mouse (cont.)



- When crowded, tend to disperse
- Live outside during summer
- Do not hibernate
- Nest in warm areas close to food
- Need very little water
- Active mostly at night (nocturnal)

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### Mouse droppings

- 50 to 75 droppings per day
- 1/8 to 1/4 inch-long, pointed
- Sign of high activity areas
- Up to 3,000 urine microdroplets produced daily

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### Mice

- Need a hole the size of a dime or a 1/4 inch crack beneath a door to enter
- Pencil

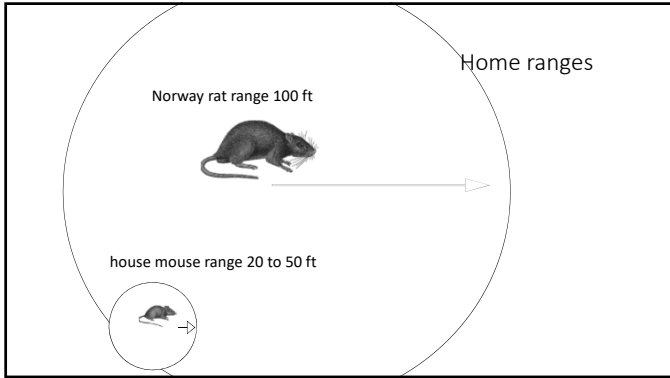
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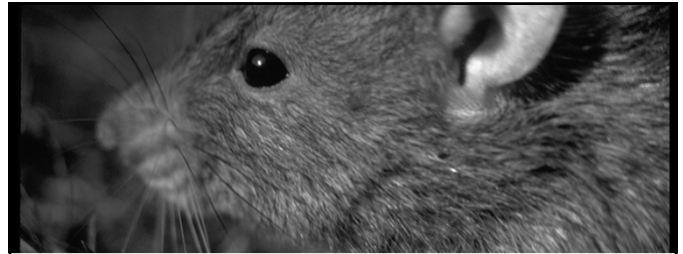
### Food preferences

- Consumes 10% body weight daily (2-4 gms)
- Opportunistic
  - people food
  - pet food
  - insects, slugs, snails
  - seeds, vegetation (outdoors)
- Grains and seeds most natural food and usually used in commercial baits
- Adapt to most commonly available foods

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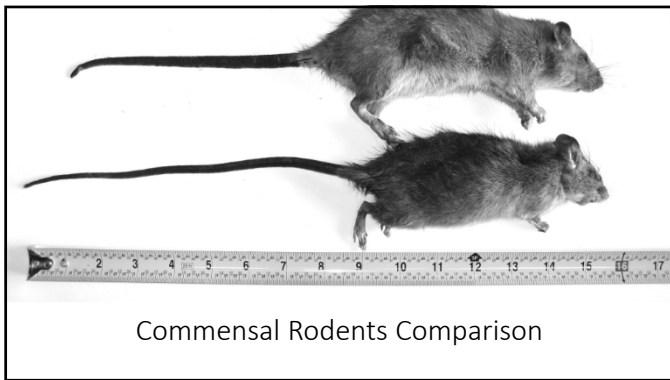


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Norway rat, *Rattus norvegicus* | Public enemy number One

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Biology of the Norway rat

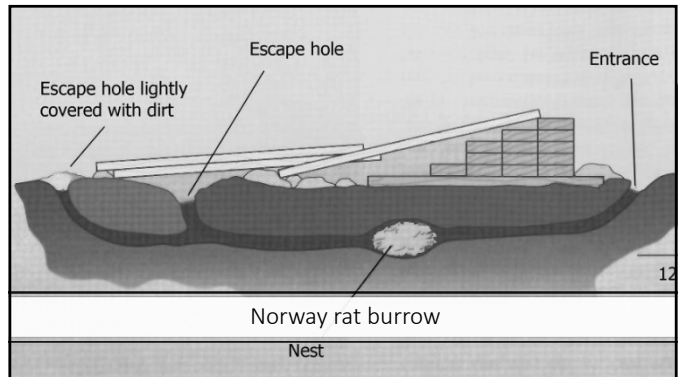
- Reproduction peaks in spring and fall
- Moderately high reproductive rates
  - 8-9 pups per litter weaned in about a month
  - Female may produce 20+ pups
- Wild rats typically live 5-12 months (3 yrs)

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Biology of the Norway rat (cont.)

- Omnivorous, opportunistic feeder
  - feed on anything humans eat
  - 0.5-1 oz per day (15-30 gm)
- Hoards and transports food
  - bait translocation a problem
- Requires water daily (1-2 oz)
- Typical family unit
  - dominant male
  - breeding female
  - up to 12 juveniles

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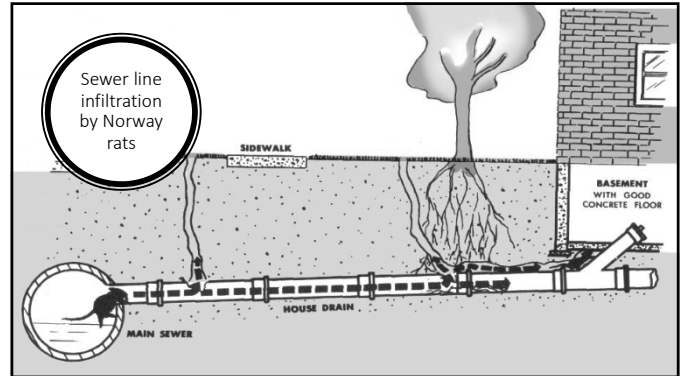
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Norway rat biology

- Feral rat populations live near woods and streams
- Excellent swimmers
- Commonly follow sewers, ditches, waterways, creeks when dispersing to new areas
- Displaced rats may travel 1 to 2 (4) miles

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Norway Rats can live anywhere


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Conditions favoring Norway rats

- Cluttered, unkempt lots and weedy areas
- Poor dumpster sanitation
- Other readily available food sources
  - bird and squirrel feeders
  - dog and cat food bowls
  - abandoned vegetable gardens
  - improperly maintained compost bins

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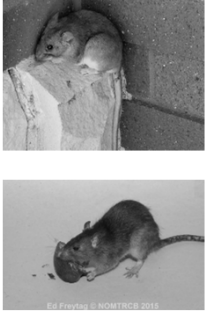


Roof rat, *Rattus rattus*

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### Roof rat biology

- Excellent climbers
- Moderate reproductive capacity
  - Female produces 3-4 litters of 4-8 pups
- Adults live 5-18 months
- Nocturnal and secretive
  - can remain undetected for long periods

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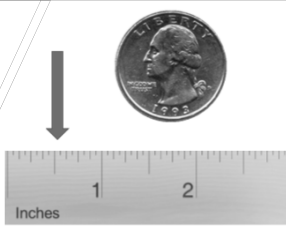
### Roof rat biology

- Prefer mature vegetation, vines, trees for harborage
- Most frequently nests above ground
- Opportunistic, self-sufficient
  - seeds, nuts, fruits, berries
  - slugs, snails
  - insects
  - fish, shellfish
  - pet food, bird seed, etc.
- Typical family group of 10 rats

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### Rats


- Need a hole the size of a quarter or a ½ inch crack beneath a door to enter
- Are very smart, cautious, and afraid of new things
- Require 0.5–2.5 ounces of food each day
- Need ~1 ounces of water every day
- Will nest close to food and water
- Prefers lines, shadows, cracks, good places to hide



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### Rodent management for sensitive environments

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### Rodent management tactics

- Inspection
- Sanitation
- Rodent-proofing
- Traps
  - snap traps
  - catch-alls
  - rat zappers
  - sticky boards
- Baits

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### Where to Inspect

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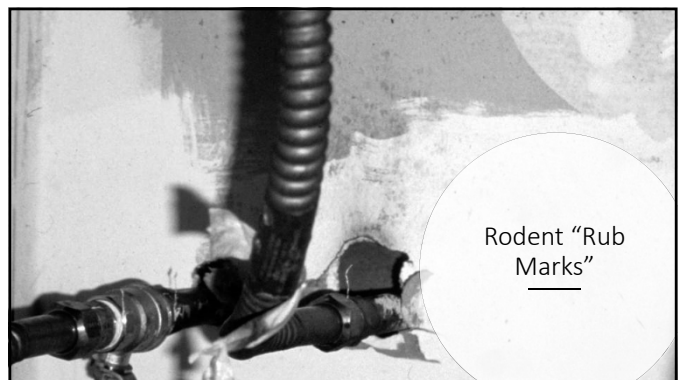
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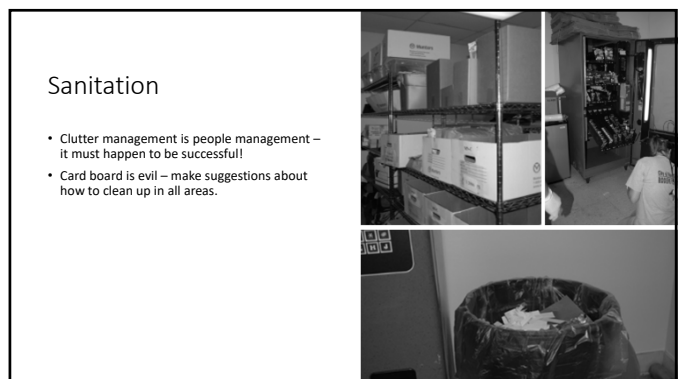
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Sanitation

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Exclusion – rodent proofing

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Advantages and disadvantages of trapping

- Relatively fast and effective
  - humane concerns with some
- Eliminates risk of odors from dead rodents
- Best for smaller rodent populations
- Labor intensive
  - requires almost daily maintenance
- As a pest management activity, requires pesticide license

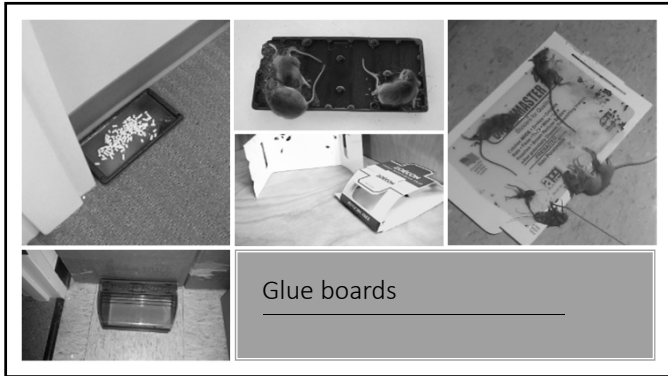

 Two circular inset images: the top one shows a Victor snap trap with bait, and the bottom one shows a white bait station.

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Catch-all or repeater mouse traps

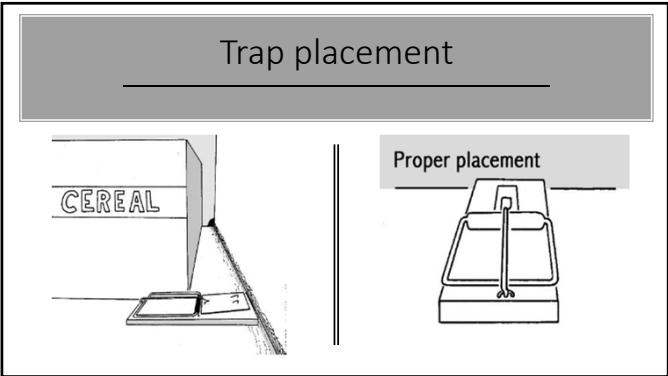

 A photograph of a Victor Mouse Trap box and a bait station.

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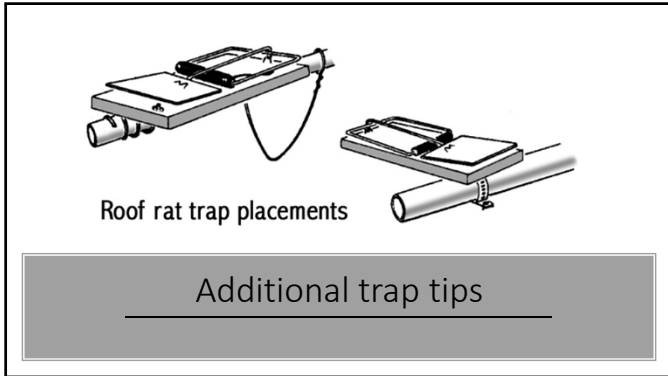


Glue boards

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Pre-baiting/Pre-trapping

- Essential for controlling large rodent populations
- Especially helpful for rats
- Leave traps unset for 1-2 weeks with food
- Catch larger percentage of population, along with neophobic rats

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Mouse Control & Food Safety

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Exclusion

- Seal any openings greater than 1/4 inch in diameter in foundations, walls, fascia, and roofs
  - For example, gaps in doors, escutcheon plates, pipe and conduit penetrations into buildings, any other opening into a building
- Screen vents with 1/4 inch hardware cloth and install door sweeps to prevent access
- If rats are entering through floor drains, seal these with hardware cloth with 1/4 inch mesh
- Install heavy-gauge kick plates at the base of any doors with evidence of rodent gnawing.
- Fill in inactive burrows with appropriate filler such as mortar for burrows in or under concrete and soil

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Non-chemical controls

- Place exterior trash cans and dumpsters away from building entrances to avoid attracting rodents to building
- Use exterior trash receptacles with tight-fitting or spring-loaded lids and close them
- Use self-contained, leak-proof compactors instead of dumpsters, or at least use dumpsters with tight-fitting lids
- Fix plumbing leaks and improve drainage to prevent water accumulation near the building
- Remove or trim ground cover and other landscape plants to expose the ground and discourage rodent travel ways and rat burrowing
- Avoid landscaping that creates ideal habitat for burrows including stone walls with unsealed gaps


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Chemical controls

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### Chemical Controls

- Rodent bait should never be used inside a structure unless you are following U.S. EPA FIFRA rules and FDA rules for placement of these devices around food establishments.
- Chemical options, including baits, should NOT be used on a routine or calendar-based schedule
- Use where rodent presence has been confirmed through monitoring or inspection and non-chemical measures are also implemented
- Bait stations should not be placed in areas frequented by children or pets such as playgrounds, bus pickup area, parks




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### Tips to Know Before You Use

- Toxic bait shall always be secured on rods in the feeding chamber of the box and never placed in the runways or entryways of the box
- Toxic bait-block formulations must be placed in EPA-approved tamper-resistant bait stations
- The stations must be secured so that they cannot be opened or easily moved
- Rodenticide baits registered for use by professional applicators to control rats and/or mice must be placed within 100 feet of buildings and other structures.
- Products require use of tamper-resistant bait stations:
  - If bait is to be placed in any indoor or outdoor location to which children under six years-of-age, pets or nontarget wildlife have access.
  - This is for all applications made outdoors and above ground per U.S. EPA FIFRA.


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### Bait station features

- Locking ability (tamper resistance)
- Bar system to secure adequate amount of bait
- Easy serviceability
- Low profile, coloration to blend with environment

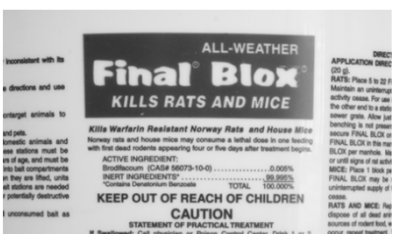
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### Types of rodenticides

- Anticoagulants-first generation
  - kill by preventing blood from clotting
  - require multiple feedings
  - Examples: warfarin, chlorophacinone, diphacinone, coumatufuryl, pindone
  - some documented resistance

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### Types of rodenticides

- Anticoagulants-second generation
  - faster acting
  - many are single feed
  - Examples: brodifacoum, bromadiolone, difethialone
  - heavy use worldwide, no resistance known yet
- Vitamin K<sub>1</sub> is an effective antidote

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### Types of rodenticides

- non-Anticoagulants
  - Bromethalin (Fastrac®, Gunslinger®, Top Gun®, Vengeance®)
  - Cholecalciferol (Quintox®, Selontra®)
    - Vitamin D
  - Zinc Phosphide (ZP® bait and tracking powders)
    - single or multiple dose
    - fast kill
- No known antidotes



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Active Ingredient	What It does	Acute Oral Toxicity	Primary Poisoning Risk	Secondary Poisoning Risk
Chlorophacinone	1st Gen: Anticoagulant, multiple dose treatment	High	Low (birds and mammals)	Low (birds), High (mammals)
Diphacinone	1st Gen: Anticoagulant, multiple dose treatment	High	Low (birds and mammals)	Moderate (birds), High (mammals)
Warfarin	1st Gen: Anticoagulant, multiple dose treatment	Moderate to high	Low (birds), Moderate (mammals). Highly toxic to cats.	Moderate (birds and mammals)
Brodifacoum	2nd Gen: Anticoagulant, single dose treatment	High	High (birds and mammals)	High (birds and mammals)
Bromadiolone	2nd Gen Anticoagulant, single dose treatment	High	Moderate (birds), High (mammals)	Moderate (birds and mammals)
Difethialone	2nd Gen: Anticoagulant, single dose treatment	High	High (birds), Moderate (mammals)	High (birds), Moderate (mammals)
Difencoum	2nd Gen: Anticoagulant, single dose treatment	High	Moderate (birds), High (mammals)	Moderate (birds), Data gap (mammals)
Bromethalin	Non-anticoagulant, single dose treatment	High	Low (birds and mammals)	Low (birds and mammals)
Cholecalciferol	Non-anticoagulant, multiple or single dose treatment	High	Low to moderate (birds and mammals)	Low (birds and mammals)
Zinc Phosphide	Non-anticoagulant, single dose treatment	High	High (birds and mammals)	Low (birds and mammals)

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## Which Product is Right For You?

Active Ingredient	Classification Type	Chemical Class	Days of feeding needed
Warfarin	Anticoagulant	Hydroxycoumarin	multiple
Chlorophacinone	Anticoagulant	Indandione	multiple
Diphacinone	Anticoagulant	Indandione	multiple
Bromadiolone	Anticoagulant	Hydroxycoumarin	single
Difethialone	Anticoagulant	Hydroxycoumarin	single
Brodifacoum	Anticoagulant	Hydroxycoumarin	single
Bromethalin	Non-anticoagulant	other	single
<b>Cholecalciferol</b>	<b>Non-anticoagulant</b>	<b>Vitamin D3</b>	<b>multiple</b>

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## Professional Structural and Agricultural Use Products

- These products include rodenticide baits registered for use by professional applicators to control rats and/or mice in or near **(within 100 feet of) buildings and other structures** or for use in and near agricultural buildings and man-made agricultural structures.
  - Products geared to these categories of users are not to be sold in "consumer" stores, including drug stores, grocery stores, hardware stores, club stores, and similar retail outlets.
  - Products containing second-generation anticoagulants must be sold in containers holding at least 16 pounds of bait if they are labeled for use by professional applicators and at least eight pounds of bait if labeled for use in or near agricultural structures.
  - Professional- and agricultural-use products containing first-generation anticoagulants, bromethalin, cholecalciferol, or zinc phosphide must be sold in containers that hold at least four pounds of bait.

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## Professional Structural and Agricultural Use Products

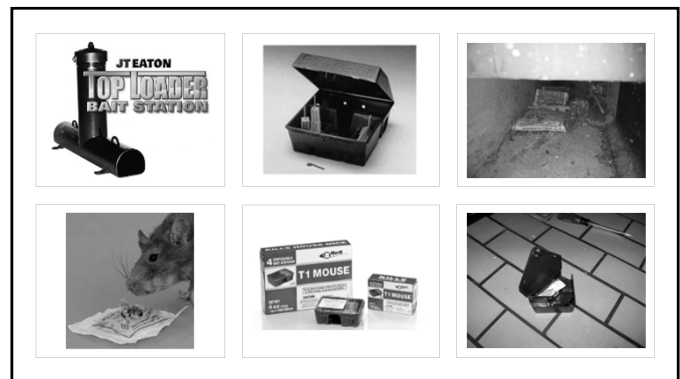
- The bait products marketed to these categories of users may be in block, paste or pelleted form. These products are not packaged in or with bait stations. However, the labels for these products require use of tamper-resistant bait stations:
  - If bait is to be placed in any indoor or outdoor location to which children under six years-of-age, pets or non-target wildlife have access.
  - For all applications made outdoors and above ground.
- Bait stations suitable for using these bait products in such areas are commercially available.
- Baiting of burrows outdoors is permitted only for pelleted baits that are placed at least six inches down active rat burrows.

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## Rodenticide Products for "Consumer" Use

- The rodenticide products currently available on the consumer market are ready-to-use bait stations that contain and/or are packaged with a rodenticide bait that is in block or paste form. Pelleted baits no longer are permitted to be used in rodenticide products targeted for consumer markets.
- The bait components of the ready-to-use bait station products currently registered for the consumer market to control mice and/or rats contain one of the following rodenticides:
  - Bromethalin.
  - Chlorophacinone.
  - Diphacinone.
- If bait stations are of a refillable design, up to one pound of bait to be used to fill or refill the bait station may be included with the bait station in the retail package. Ready-to-use bait stations that are not refillable must be properly disposed after the bait in them has been consumed or contaminated.
- Ready-to-use bait station products are labeled for use:
  - Indoors; or
  - Indoors and outdoors within 50 feet of buildings.
- Where a specific product is authorized for use depends upon whether the bait station component of the product has been shown to be resistant to tampering by young children and by dogs as well as whether the unit has been found to be weather-resistant. Read the labels of these products before purchasing any of them to make sure that the product obtained is labeled for use in the place(s) that you intend to apply it.

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## Keep these tips in mind when using rodenticides:

- If you choose to use rodent bait, always follow the label, it's the law.
- Identify your rodent first. Some bait types are more effective for certain species than others.
- Try a combination of control methods. Consider prevention, sanitation, and exclusion before using a rodenticide. Then try a lower toxicity product first.
- Rodent baits can be attractive and dangerous to kids, pets and wildlife. Always store pesticides in a cool, dry place that's not accessible to children and pets.
- Use bait stations, rather than broadcast rodenticides, to minimize access for children and pets.
- Use gloves when disposing of dead rodents. Secure trash cans to minimize pet or wildlife access to poisoned rodents.
- Many rodenticide baits can be toxic to wildlife. If they are eaten, or if an animal eats a rodent that was recently poisoned. If you suspect an animal may have been poisoned, please contact NPIC at 1-800-858-7378 to talk with a Pesticide Specialist.

## Questions

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