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Controlling House Mice

Stephen Vantassel, Project Coordinator — Wildlife Damage
 Scott Hygnstrom, Extension Wildlife Damage Specialist
 Dennis Ferraro, Extension Educator—Douglas/Sarpy County

Ways to recognize and control damage caused by house mice.

House mice (*Mus musculus*) are highly adapted to human environments and can thrive under a variety of conditions. They are found in and around homes and farms, as well as open fields and agricultural lands.

The house mouse is a significant pest in the United States and causes an estimated \$20 million in damage to stored feeds and structures in Nebraska every year. House mice consume and contaminate food meant for humans, livestock, and other animals. They also damage structures and property, and transmit diseases such as salmonellosis and swine dysentery.

Recognizing Mouse Infestations

Property owners typically become aware of mouse activity after discovering droppings. House mice deposit approximately 50 to 75 pellets per day as they explore their environment. Mouse droppings usually do not collect in piles. Droppings average 1/8 to 1/4 inch in length with one or both ends narrowing to a point (*Figure 1*). On rare occasions the droppings will appear round. The droppings are usually black in color, but will vary according to the mouse's diet. Fresh gnaw marks, 1/32 inch wide, provide another clue that mice are present. Mice typically gnaw 1 1/2 inch diameter, clean-cut holes into cardboard and similar products. They will also gnaw electrical wiring, soap, and other soft items. Mouse nests, made from finely shredded paper or other fibrous material, are often found in sheltered locations. Occasionally, scratching and squeaking sounds emanate from ceilings and walls, signifying the presence of mice. People are frequently surprised to learn that mice can be responsible for so much noise. A musky odor can result from an area having significant mouse contamination. Finally, mice may be seen during their nocturnal travels, or less frequently, during daylight hours.



Figure 1. Mouse droppings average 1/8 to 1/4 inch in length.

House Mouse Facts

House mice are small rodents with relatively large ears and small black eyes. They weigh about 1/2 to 1 ounce and usually are light gray in color. An adult is about 5 1/2 to 7 1/2 inches long, including the 3- to 4-inch tail.

Although house mice prefer cereal grains, they will eat almost anything. An adult consumes only 1/10 of an ounce of food per day by nibbling bits of food during its travels. Mice also cache food as supply permits. The sensory capabilities of mice are remarkable. Although their ability to perceive objects is limited to 1 to 2 feet, they can see movement up to 45 feet. Mice are partially color blind as they are unable to see the color red. Mice can hear below 45 KHz. Their sense of smell is highly developed, allowing them to detect down to 250 parts per billion. Mice maintain contact with walls with their whiskers and guard hairs to guide them during their nocturnal travels.

House mice have superb physical abilities. They are capable of climbing any rough vertical surface, balancing along horizontal wire cables or ropes, and jumping vertically onto a flat surface 12 inches above the floor. Mice also can reach speeds of 4 to 6 mph and bound across 3-foot gaps. They are even tough enough to survive a 9-foot vertical drop. Mice can squeeze through openings slightly larger than 1/4 inch in diameter.

Mice are capable of exponential population growth. In a single year, a female can raise five to 10 litters, of five to six young each. Young are born 18 to 21 days later and reach reproductive maturity in six to 10 weeks. The life span of a mouse is usually nine to 12 months.

House Mouse Control

Effective control involves three aspects: sanitation, mouse-resistant construction, and population reduction. The first two are preventive measures. When mice are already established in an area, some form of population reduction almost always is necessary. Reduction techniques include trapping and toxicants.

Sanitation. Proper sanitation involves reducing available shelter and food from the interior and exterior of buildings. Mice cannot maintain large populations when the availability of living space and food are restricted. Begin your inspection by looking in areas that are located within 50 feet of food and also provide warmth, shelter, and protection from predators. Mice will inhabit debris piles, infrequently moved inventory,

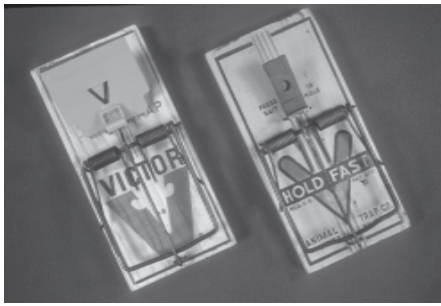
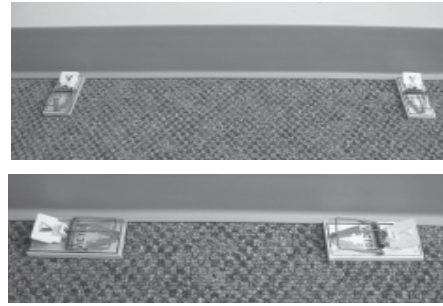


Figure 2. Snap traps — Expanded trigger and narrow trigger.



Figures 3 and 4. Proper snap trap placement on wall.



Figure 5. Ketch-All® and the Victor Tin Cat® multiple-catch traps.

stacked wood, insulation, and other inaccessible areas. Reduce available shelter by removing debris, and moving and neatly restacking old inventory and woodpiles. Whenever possible, keep materials at least 8 inches off the ground and at least 1 foot away from vertical walls. The space reduces the attractiveness to mice and allows for easier inspections of mouse activity. Reduce the availability of food by removing bird feeders, securing food (including pet food) in tight fitting bins, and cleaning up spills. Total elimination of mice through sanitation, however, is almost impossible, as mice can survive in small areas with limited amounts of food and shelter. On the other hand, any neglect of sanitation will cause even the most aggressive control efforts to fail, due to the rapid reproductive rate of house mice.

Rodent-resistant construction. Mouse-proof construction is another key element in an effective mouse control program. Mice are attracted to buildings when they detect openings and escaping heat. Prevent mouse entry by eliminating all openings larger than 3/16 of an inch. Gaps around pipes can be secured with steel wool and caulk or mortar to stop airflow. Since steel wool rusts, many prefer to use a copper woven-wire mesh. It doesn't rust and its flexible design allows it to be wedged into small cracks and crevices by hand or with a regular head screw driver. Complete the job with quality caulk or mortar to prevent air movement. Larger openings can be secured with wood, aluminum flashing, concrete or 1/4-inch wire mesh. Doors, windows and screens should fit tightly. Cover the edges of doors and windows with metal to prevent gnawing. Latex, plastic, rubber, boards less than 1/2 inch thick, or other soft materials are unsuitable for plugging holes used by mice. Refer to NebGuides G1530, *Rodent-Proof Construction Structures*, and G1217, *Rodent-Proof Construction - Drains and Feeding Equipment*, for more information.

Population Reduction. Mouse populations can be managed through the use of traps and toxicants.

Traps. Trapping is the preferred method for controlling mice in homes, schools, hospitals, and other sensitive areas for several key reasons: 1) it is pesticide free; 2) it permits the user to view his or her success; 3) it is versatile, as traps can be placed in a variety of areas and sets; and 4) it allows for disposal of trapped mice, thereby eliminating the potential for odors from the carcasses of dead mice. Successful trapping requires the trapper to identify where the mice may be living and to employ a sufficient number of traps. Mice seldom venture farther than 50 feet from their shelter and food supply, but they will actively explore their territory, leaving their nest up to 40 times per day. Place traps behind objects, in dark corners and areas where droppings have been found. Concentrate traps in areas where mouse activity is evident. Space traps no more than 10 feet apart in areas where mice are active. Mice are most active before dawn and after dusk, so check traps in the

morning to maximize success. As a rough guide, two dozen properly placed snap traps will be sufficient to control a new mouse infestation in a 1,500 ft² structure.

Snap traps come in a variety of models and designs. All are effective in catching mice. Traps with expanded triggers, however, have a higher capture rate (Figure 2). Set the triggers lightly so the traps will spring easily. Place them close to walls so mice will pass directly over the trigger (Figures 3-4). Double setting (placing two traps close to each other) is recommended in situations with high mouse activity. Be sure that at least 1 inch separates traps placed in a double set. Traps positioned in this way can be baited or not. If you decide to bait, use peanut butter, caramel, chocolate, whole canary grass (*Phalaris canariensis*) seed, or nesting material, such as cotton balls and soft cloth. Leave traps unset until the bait has been taken at least once to reduce the chance of mice becoming trap-shy. If food baits disappear without the trap firing, then the culprit could be insects or mice. Set traps with a light or "hair trigger" or move traps to a new location. Secure a cloth to the trigger and apply a food lure to the cloth-covered-trigger. The cloth will absorb the bait, forcing the mouse to tug at the cloth, thereby triggering the trap. Although more expensive, many people like clam-style traps, as they allow easy setting and removal of trapped mice.

Multiple-capture traps for mice, such as the Victor Tin Cat® and the Ketch-All® (Figure 5) also are available in hardware and feed stores. They can catch several mice at a time without being reset, thereby reducing labor requirements. Some multi-catch traps can be used in conjunction with glue boards to ease cleaning and removal of carcasses. Multiple catch traps are especially useful outdoors to catch mice before they can enter your building.

Glue boards are an alternative to traps. They catch and hold mice that are attempting to cross them, in much the same way that flypaper catches flies. Glue boards must be placed along walls where mice travel. Some glue boards are scented with artificial peanut butter oil, while others are unscented. Both are effective. Never place peanut butter directly on the glue, as the peanut oil will dissolve the glue, rendering it ineffective. Instead, place the peanut butter inside a plastic soda bottle cap and set it in the middle of the glue board. Sometimes mice learn to recognize the dangers of glue boards and attempt to jump over the board. In these situations, place an additional board next to the original one to increase the required jumping distance. Glue boards lose their effectiveness in dusty areas unless covered. Extreme temperature also may affect the tackiness of glue boards. Do not use them where children, livestock, pets, or desirable wildlife can contact them. If a child or nontarget animal gets caught, use vegetable oil to dissolve the glue.

Box traps (live mouse traps) for mice are not recommended as mice should not be relocated. House mice are a

Table I. Nonanticoagulant rodenticides and the percentage of active ingredient commonly used for house mouse control.*

Common name	Percentage active ingredient	Brand Names
Bromethalin	0.01	Alliance [®] , Assault [®] , Clout All [®] , Fastrac [®] , Hot Shot [®] , Gunslinger [®] , Rampage [®] , Real-Kill [®] , Tomcat [®] , Top Gun [®] , Trounce [®]
Cholecalciferol	0.075	Quintox [®] , Rampage [®]
Zinc phosphide	2.0-10.0	Zinc phosphide, Eraze [®] , ZP [®]

Table II. Anticoagulant rodenticides and the percentage of active ingredient commonly used for house mouse control.*

Common name	Percentage active ingredient	Brand Names
Brodifacoum	0.005	d-Con [®] , Enforcer [®] , Final [®] , Jaguar [®] , Ropax [®] , Talon-G [®] , WeatherBlok [®]
Bromadiolone	0.005	BootHill [®] , Catchmaster [®] , Contrac [®] , Hawk [®] , Just One Bite [®] , Maki [®] , Roc-622 [®] , Tomcat [®] , Victor [®]
Chlorophacinone	0.005-0.2	Enforcer [®] , JEaton [®] , RoZol [®]
Difethialone	0.005	Generation [®]
Diphacinone	0.005	Ditrac [®] , Enforcer [®] , Tomcat [®]
Warfarin	0.025	Alliance [®] , Bar Bait [®] , Dean's [®] , Ferret [®] , H-K [®] , Kaput [®]

*To simplify information, trade names of some products have been used in the text and tables. The information in this publication is supplied with the understanding that no endorsement of specific products named, nor discrimination of products not named, is implied by University of Nebraska–Lincoln Extension.

non-native and invasive species that should not be released alive in Nebraska. Additionally, relocation is very stressful to the animal as it has to reorient itself to a new area, obtain shelter and locate food while avoiding predators.

Rodenticides. Toxic bait rodenticides come in a wide variety of active ingredients and formulations. We recommend commercially-prepared rodenticides because they reduce the hazards associated with bait handling and mixing. You can further increase safety by purchasing toxicants mixed with a bittering agent called Bitrex[®]. This additive makes the bait less palatable to nontarget animals.

Nonanticoagulant rodenticides. Nonanticoagulant rodenticides are more toxic than anticoagulant rodenticides. In addition, no antidotes are available for nonanticoagulant baits. Therefore, single dose toxicants should be used by professional pest control operators or other persons familiar with their use. Nonanticoagulant rodenticides (Table I) provide a quick knockdown of a mouse population. They may be preferred where mice are abundant or where it is difficult to get mice to accept bait for several days in succession due to competing food items.

Bait acceptance can be increased by “prebaiting” with nonpoisoned bait for several days before the rodenticide is offered. If acceptance of prebait is poor, do not apply toxic bait, but change bait material or its placement. “Bait shyness” can occur with some nonanticoagulant rodenticides such as zinc phosphide, so it is best to use them only once per year at any location.

Remove all uneaten bait at the end of a baiting program and dispose of according to the label’s instructions. Never leave nonanticoagulant baits exposed to the elements for more than four days.

Anticoagulant rodenticides. Anticoagulant rodenticides (Table II) generally are considered much safer than nonan-

ticoagulant rodenticides because of their lower toxicity and known antidote (vitamin K). Anticoagulants cause death as a result of internal bleeding, which occurs as the blood loses the ability to clot and capillaries are damaged. The active ingredients are used at very low levels, so bait shyness does not occur when using properly formulated baits.

Mice must feed on some anticoagulant baits for several days before a lethal dose is ingested. Fresh bait must be made available to mice continuously for at least two weeks, or as long as feeding continues. Some anticoagulant baits have been formulated so that mice receive a lethal dose in one feeding, but they will not die for several days.

Bait selection and placement. Several types of anticoagulant baits are available. Grain baits or pelleted forms often are purchased in bulk or packaged in small plastic, cellophane, or paper packets. These “place packs” keep baits fresh, and make it easy to place baits into burrows, walls, or other locations. Mice will readily gnaw into place packs, and feed on baits. However, pellets are also more likely to be cached by mice, thereby raising the risk of translocating the bait to an unsafe area. Bait blocks or bars are a useful alternative if translocation of bait is a concern.

Some anticoagulant baits are formed into paraffin blocks and are useful in damp locations, such as sewers or gutters, where loose grain baits and other blocks spoil quickly. Unfortunately paraffin blocks are not accepted by mice as readily as other baits. Therefore, most rodenticides are formulated as cold-extruded bait blocks. They typically include processed grain and flavor enhancers to increase attractiveness. The blocks have several edges that are attractive to gnawing rodents and holes that are convenient for mounting in bait stations.

Anticoagulant baits are also available as sodium salts mixed into a water solution. Although mice require little free water to survive, water baits can be effective where moisture is scarce and mice are feeding on dry grain or livestock feed. Consider using water baits as a supplement to other control measures.

Proper placement of baits is important for house mouse control. Place baits no more than 10 feet apart in areas where mouse activity is evident. If mice are living in wall spaces, place baits inside the walls or in areas where mice can exit the walls, such as along pipes, at the foundation, or in the attic. Some county health departments do not allow baits or toxicants in public (food) establishments or schools.

Sometimes mice avoid or become resistant to a particular toxicant, especially if it has been used for a long time. Usually this avoidance behavior is due to bait spoilage, poor placement or excessive (nontoxic) food availability. Correcting those issues will normally resolve the problem. If it doesn’t, consider switching to a toxicant with a different active ingredient (see Tables I and II).

We highly recommend using tamper-resistant bait stations (bait boxes) when applying any toxic bait. They protect rodenticides from weather and provide a safeguard to people, pets and other animals. In addition, mice like confined, dark spaces and ingest more toxicant inside bait stations. Bait stations should have at least two openings, about 1 inch in diameter and should be large enough to accommodate several mice at one time. Place bait boxes next to walls (with the openings close to the wall) or in other places where mice are active. Clearly label all bait boxes “Caution — Mouse Bait” as a safety precaution. Establish bait stations in and around the perimeters of buildings where it is impossible to exclude rodents. Place fresh anticoagulant bait in these stations to control invading mice before breeding populations become

established. For more information, refer to NebGuide 1215, *Bait Stations for Controlling Rats and Mice*.

Fumigants. Fumigants (toxic gases) occasionally are used to treat structures, railway cars, or other enclosed areas. Aluminum phosphide is the most commonly used fumigant registered for house mouse control. Fumigation for insect control, with other products, often leads to the incidental death of house mice. Where practical, fumigation is a quick way to achieve 100 percent rodent control. Fumigation can be quite expensive, especially when a building must be completely tarped to contain the fumigant. Caution: fumigants are highly toxic to humans and other animals, and must not be used where occupants of a building could be exposed to the gases. Only licensed structural pest control operators should use fumigants in any building or enclosed structure. Refer to NebGuide G1477, *Fumigation of Burrowing Rodents with Aluminum Phosphide or Gas Cartridges*, for more information.

On rare occasions, general use toxicants can't resolve a mouse problem. Pest control operators (found in your phone book) have access to Restricted Use Pesticides registered for controlling mice. To obtain your own Pesticide Applicators License, contact your local extension educator.

Electronic devices. Although mice are easily frightened by strange or unfamiliar noises, they quickly become accustomed to regularly repeated sounds. Ultrasonic sounds (those above the range of human hearing) have very limited use in rodent control because they are directional and do not penetrate through objects. They also quickly lose their intensity with distance. Researchers have found little evidence of electronic, sound, magnetic, or vibrating devices driving established mice or rats from buildings or providing adequate control.

Predators. Although cats, dogs, owls and other predators may kill mice, they do not provide effective mouse control in most circumstances. Mice often live in very close association with dogs and cats. Mouse problems around homes often are related to the food, water, and shelter provided to pets.

Safety precautions. Carefully follow all product label recommendations. In addition, certain general safety precautions should be followed. Consider all rodenticides dangerous enough to cause death, and place baits where only rodents can access them. All rodenticides present some degree of hazard to humans, livestock, pets, and other nontarget animals. Use prepared or ready-to-use baits to reduce the risks involved in handling concentrated toxicants. Label all bait containers and bait stations clearly with appropriate warnings. Store unused bait, concentrates, and fumigants in a locked cabinet out of the reach of children or animals.

Clean up. Pick up all accessible dead mice after a poisoning program. The following information is for small clean up areas such as in a closet. Additional protective measures should be taken in situations where fecal contamination is substantial, over a large area, or where deer mice (*Peromyscus maniculatus*) have been identified. For more information on rodent diseases visit the Centers for Disease Control Web site, www.cdc.gov.

House mice are not known to be carriers of hantavirus. However, since few people will take the time to conclusively

identify the rodents in their home, we advise that caution be used in all cleanup activities.

Disposal of Dead Mice. Wear protective latex gloves (vinyl if allergic), and spray the carcass and trap with household disinfectant (eg. Lysol®) or a 10 percent solution of bleach and water (Figures 6-7). Spray until wet. Turn a sealable plastic bag inside out, insert your hand, and grab and remove the mouse from trap. Turn the bag right side out so that the mouse is inside the bag. Seal the bag. Wrap the bagged mouse in newspaper or place it in a box and dispose of it with other household wastes. Spray the trap and area of the original set with disinfectant and let dry. Carefully remove gloves by turning them inside out and dispose of them with other household waste. Wash hands thoroughly. Be forewarned that some surface staining may occur with the use of disinfectants.

Rodent Feces. Wear gloves as before and spray the feces and area with disinfectant until wet. It is critical that the feces and surrounding dust does not become airborne. Do not use a household vacuum or broom to collect feces. Wet a towel or rag and wipe up fecal material. Dispose of feces and cleanup materials with other household wastes.



Figures 6 and 7. Proper removal of dead mice.

For additional information, explore the Internet Center for Wildlife Damage Management (ICWDM) (icwdm.org) and the book *Prevention and Control of Wildlife Damage* available on the ICWDM site or contact your local extension office.

Reference to commercial products or trade names is made with the understanding that no discrimination is intended of those not mentioned and no endorsement by University of Nebraska–Lincoln Extension is implied for those mentioned.

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