

CONTROLLING MICE AND RATS



Controlling Mice and Rats

by Rebecca McPeake, Professor - Wildlife

House mice (*Mus musculus*), Norway rats (*Rattus norvegicus*), and roof rats (*Rattus rattus*) are members of the Order Rodentia and Family Muridae. Referred to as commensal rodents, they often live in close proximity to people and depend on humans for their habitat needs. Sixteen species of rats, mice, and voles are native to Arkansas, but commensal rodents are not native. They are believed to have arrived in North America on ships with early settlers from Europe and Asia and then spread throughout the country.

These rodents contaminate human and animal food with their hair, urine, and droppings. They also cause an inestimable amount of damage to structures, particularly wall and attic insulation, electrical wiring, and plumbing. Rats burrow under building foundations and slabs, gnaw on electrical wiring and water pipes, and chew openings through doors, windowsills, walls, ceilings, and floors.

Commensal rodents and their parasites transmit a number of diseases to humans, including salmonellosis (food poisoning), rickettsialpox, murine typhus, lymphocytic choriomeningitis, leptospirosis, trichinosis, ratbite fever, tapeworms, and organisms that cause ringworm. Of the two commensal rat species, roof rats are more commonly associated with the plague.

Identification

Correct identification is important for determining the appropriate strategy for removal.

House Mice

The house mouse (Figure 1) is a small, slender rodent that is well adapted to living in people's homes, farms, and commercial establishments, as



Figure 1. House mice are generally grayish brown with a gray or buff belly, a slightly pointed nose, and small, black, somewhat protruding eyes. Their nearly hairless tail has obvious scale rings.

well as in open fields and agriculture lands. House mice are prolific. Females can produce as many as 13 litters in a year, averaging between 4 and 7 young per litter. Adults weigh between 0.35 to 1.1 ounces and range from about 5 to 8 inches in total length from head to tail.

House mice can be distinguished from young rats by the comparative size of their feet and head. A young rat will have larger hind feet and head in proportion to the body than a house mouse.

Norway and Roof Rats

Norway and roof rats are well adapted to living in people's homes, farms, warehouses, stores, and sewers. Rat populations can expand rapidly, making them difficult to control. Females can produce 6 to 12 young in 21 days, and sexual maturity is reached at 3 months. The average female rat has 4 to 6 litters annually.

The Norway rat (Figure 2) is also called the brown rat, house rat, barn rat, sewer rat, gray rat, or wharf rat. The Norway rat is a stocky, burrowing rodent that weighs about one pound on average. Adults measure about 11½ to 18 inches in total length from head to tail. Fur coloration varies from



Figure 2. A Norway rat is a stocky, burrowing animal whose hairless tail is shorter than its body.

brownish or reddish gray above and whitish gray on the belly, although blackish Norway rats can occur. Though they can climb, Norway rats tend to reside closer to the ground or on lower floors of buildings. They may burrow to make nests under buildings, beneath concrete slabs, along stream banks, around ponds, in garbage dumps, and other locations where suitable food, water, and shelter are present (Figure 2).

The roof rat (Figure 3) is also called the black rat or ship rat. Fur coloration varies from black with a gray belly, agouti (brownish streaked with gray) back and gray belly, or agouti back and white belly. Adults measure about 13 to 18 inches in total length from head to tail. Compared to Norway rats, roof rats are more sleek and graceful, and generally not as large. Their belly fur is uniformly white, buff, or



Figure 3. A roof rat is sleeker than a Norway rat with a tail that is longer than its body in length.

gray compared to Norway rats, whose belly fur is white with gray underfur. Roof rats have a pointed muzzle, larger ears, and a tail that is longer than their body. Roof rats are more aerial than Norway rats in their habitat selection and often live in trees or vine-covered fences. Unlike Norway rats, roof rats prefer to nest off the ground and rarely dig burrows for living quarters. Roof rats frequently enter buildings from the roof or overhead utility lines. They tend to inhabit upper floors while Norway rats occupy the first or basement floors. Occasionally, they may live in sewer systems.

Habits and Feeding Behavior

House mice eat many types of foods but prefer those high in fat, protein, or sugar. They relish bacon, chocolate, butter, peanut butter, and nutmeats. House mice readily eat new foods. A single mouse may eat only about a tenth of an ounce of food per day (2½ pounds per year) but destroys considerably more food than it consumes. Mice have a habit of nibbling on many foods and discarding partially eaten items.

Studies indicate that during its daily activities, a mouse normally travels an area averaging 10 to 30 feet in diameter. Mice seldom travel farther than this to obtain food; they obtain water from the food they eat. Mice can survive without free-standing water, though they will drink when it's available. A lack of water or food with adequate moisture content can inhibit their population growth. Because of their limited movement and feeding behavior, house mice can be difficult to control in some situations.

Rats prefer fresh, wholesome items over stale or contaminated foods. They use their keen sense of smell to locate food items and can taste contaminants as low as 0.5 parts per million. Rats eat cereal grains, meats, fish, nuts, and some types of fruits. Roof rats do very well consuming dog or cat food. One rat can eat about a half a pound per week, and probably contaminate 10 times that amount with its urine and droppings. Many rat species hoard considerable amounts of solid food in attics, wood piles, or behind boxes in a garage, which they find and eat later. They require ½ to 1 ounce of water daily when feeding on dry foods, but need less water when moist foods are consumed.

Rats are primarily nocturnal, though some may be active during daylight when their population is high. Studies indicate that a Norway rat normally travels an area averaging 100 to 150 feet in diameter, seldom traveling more than 300 feet from a burrow to obtain water. Roof rats will travel 100 to 300 feet for food and can be seen at night running along overhead utility lines or fences. Rats constantly explore and learn about their environment, memorizing the locations of pathways, obstacles, food and water, shelter, and other elements in their territory. They quickly detect and avoid new objects placed in their environment, such as a trap or bait.

Mouse Sign

Mouse **droppings** are $\frac{1}{4}$ inch long, whereas those of cockroaches are usually smaller at $\frac{1}{8}$ to $\frac{1}{4}$ inch long. Under a magnifying glass, cockroach droppings show distinct longitudinal ridges and squared-off ends. In comparison, mouse droppings are smooth and have tapered or rounded ends. Mouse **tracks** can be seen on dusty surfaces or in mud, or flour can be spread on the floor overnight to determine if rodents are present. The hind foot is about $\frac{1}{2}$ to 1 inch in length. **Urine** will fluoresce under ultraviolet light and may occur along travel ways or in feeding areas. **Rub marks** may occur on beams, rafters, pipes, or walls. They are the result of oil and dirt rubbing off the mouse's fur. **Gnawing** may be visible on doors, ledges, in corners, in walls, on stored materials, or other surfaces. Fresh wood shavings or chewed insulation indicate active infestations. Mouse holes are often $1\frac{1}{2}$ inches or less. **Sounds** such as gnawing, climbing in walls, running above ceilings, and squeaks are common when mice are present. A characteristic musty **odor** is a positive indication that house mice are present. **Visual sightings** can occur during daylight or after dark using a flashlight. **Nests** may be found when cleaning garages, closets, attics, basements, and outbuildings. They are constructed of shredded fibrous materials such as paper or burlap, and appear as a ball of loosely woven material usually 4 to 6 inches in diameter.

Rat Sign

Rat **droppings** may be as large as $\frac{3}{4}$ inch long and $\frac{1}{4}$ inch in diameter. Rat **tracks** can be seen on

dusty surfaces or in mud, or flour can be spread on the floor overnight to determine if rodents are present. Both Norway and roof rat's hind feet are about 1 to $1\frac{1}{4}$ inches in length. **Urine** will fluoresce under ultraviolet light and may occur along travel ways or in feeding areas. **Runs or burrows** may be found next to walls, along fences, next to buildings, or under bushes and debris. **Smudge or rub marks** may occur on beams, rafters, pipes, or walls as a result of oil and dirt rubbing off the rat's fur. **Gnawing** may be visible on doors, ledges, in corners, in walls, on stored materials, or other surfaces. Fresh wood shavings or chewed insulation indicate active infestations. Rat holes are 2 inches or larger. **Sounds** such as gnawing, climbing in walls, running above ceilings, and squeaks are common when rats are active.

Methods of Control

Three essential steps for effectively controlling commensal rodents are (1) applying sanitation practices and habitat modification, (2) rodent-proof construction, and (3) population reduction.

Step 1: Sanitation and Habitat Modification

Sanitation practices (Figure 4) are an effective tool when used in conjunction with rodent-proofing techniques and population reduction methods. Mice can live off a few crumbs or scraps and therefore cannot be controlled by good sanitation practices alone. However, poor sanitation will attract rats and mice, and permit them to thrive in greater

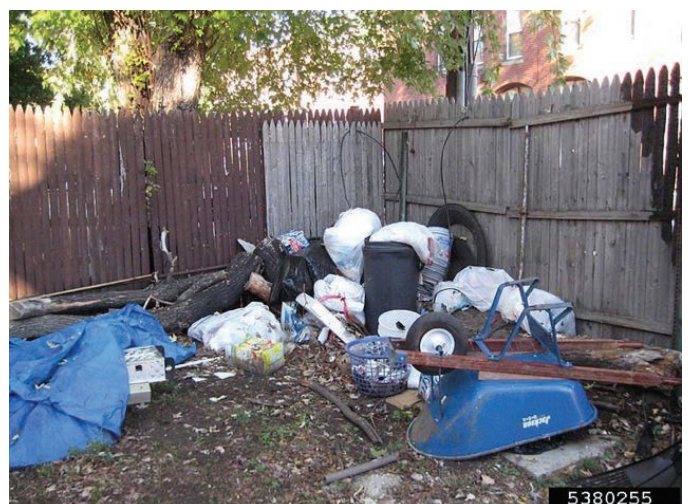


Figure 4. Debris can offer ideal rodent harborage.
Photo courtesy of Gary Alpert, Harvard University, Bugwood.org.

abundance. Good sanitation aids in rodent control by (1) permitting easier detection of rodent sign, (2) increasing the effectiveness of traps and baits by reducing alternative food sources, and (3) reducing the growth of the rodent population.

Studies indicate that poor sanitation is one of the basic reasons that moderate to high rat populations flourish in urban and suburban areas. Sanitation involves good housekeeping, including proper storage and handling of food, feed, and edible garbage. Pet foods are often a food source for rats in and around homes. Store in metal rodent-proof materials and feed pets only what they will consume at a single feeding. Garbage and rubbish from homes, restaurants, and other such sources should be properly stored and disposed of. A proper refuse storage container is heavy-duty, metal, rust-resistant, and equipped with a tight-fitting lid. Containers should set on racks or stands to prevent rusting, minimize the chance of being overturned, and reduce rat shelter under containers.

Modifying rodent habitat around the home may also help in controlling their numbers and access into the home. Regular removal of debris and control of weeds around homes will reduce shelter available to rodents. Maintaining a clean, 3-foot wide weed-free area around building foundations, concrete slabs, and footings often discourages rodents from burrowing, as well as eliminates a food source. In some instances, placing a strip of heavy gravel around building foundations will reduce rodent burrows. Gravel should be at least 1 inch in diameter and placed in a band at least 2 feet wide and ½ foot deep.

Keep the perimeter clean of debris, including stacked firewood and other materials. Eliminate vines growing on buildings and overhanging tree limbs that roof rats may use as travel routes. Dense shrubbery, vine-covered trees and fences, and vine ground cover make ideal habitat for roof rats. Severe pruning and/or removal of certain ornamentals is often required to obtain lasting rat control. Remove pre-harvest fruits or nuts that drop in backyards. Collect and remove all unwanted fruit when harvest is over. Discontinue feeding birds as seeds could be an attractant for rodents.

Step 2: Rodent-Proof Construction

Rodent-proof construction is the best defense for preventing problems with rodents. To prevent rodent entry, their capabilities need to be understood.

Both mice and rats can:

- Run along or climb electrical wires, pipes, fences, poles, ropes, cables, vines, shrubs, and trees to gain entry into a building.
- Climb almost any rough vertical surface, including weathered sheet metal and many plastic products.
- Crawl horizontally along or through pipes, augers, conveyors, conduit, and underground utility and communications lines.
- Gnaw through a variety of materials including lead, aluminum sheeting, window screens, wood, rubber, vinyl, fiberglass, plastic, and low-quality concrete or concrete block.
- Travel considerable distances crawling upside-down along screen wire.

Mice can:

- Jump as high as 18 inches from a floor onto an elevated surface.
- Survive and reproduce at temperatures of 24 degrees F if adequate food and nesting material are available.

Rats can:

- Jump as high as 36 inches vertically and as far as 48 inches horizontally.
- Drop 50 feet without being seriously injured; burrow straight down into the ground for at least 36 inches.
- Reach as high or wide as 13 inches.
- Swim as far as ½ mile in open water, dive through water traps in plumbing, and travel in sewer lines against substantial current.

To exclude mice, seal all holes and openings larger than ¼ inch across. Rats can squeeze into holes and openings ½ inch across. Use heavy materials that will withstand rodent gnawing, such as concrete, galvanized sheet metal, and heavy-gauge hardware cloth.

When inspecting for potential entryways, look for sign. Pay attention to areas behind, under, or in appliances, sinks, cabinets, drawers, stored goods, wall voids, false ceilings, and other undisturbed areas. Rodents can enter under doors, through holes beside water pipes and electrical conduit, and through the cold air return ducts on forced air furnaces, especially those located in outside cabinets or garages, and underneath mobile homes. In areas with high rat populations, both species can enter buildings through toilets and uncovered drains. A “rat guard” one-way flap can be installed in toilets to prevent entry.

Mice and rats often find easy access to garage areas through open doors or under poor-fitting garage doors. Once inside the garage, they may gain entry into the main structure along electrical lines, pipes, poorly sealed firewall sheathing, around furnace ducts, hot water heaters, or laundry drains.

Pay particular attention to utility entry points including aerial (roof rats) and underground (Norway rats, house mice) electrical and communication trunk lines, and exhaust vents for clothes dryers. Check all roof joints for tightness and presence of flashing, particularly if rodents have access to the roof via wire, pipes, plants, or rough-textured walls. Also, check roof and sewer vents for adequate screening and sealing. Chimneys should be checked for properly installed flashing or missing mortar.

If rodents are able to reach the attic, they may travel from room to room through openings for pipes, ducts, and wiring. Also, inside entry can be achieved through the fireplace, which may have poorly fitted sheeting or metal collars, an open damper, or cool air and warm air returns around the fire box. If the outside cannot be sealed, glass doors that seal the burn area are recommended to prevent entry throughout the year.

Gaps in foundations and slabs, or where the wall framing meets the foundation or slab floor, may provide large enough openings for entry. Older buildings commonly have cracked foundations, cracked plaster or mortar, warped siding, or broken and torn vent screens. Wood or masonite siding is especially vulnerable to warping and cracking near corners and around the base of the building. Old, unused holes where utilities formerly entered the structure are also common points of entry.

Recommendations for Repairs

Holes and openings: For a temporary plug, seal with steel wool, copper gauze, or screen wire packed tightly into opening. For a permanent repair, mix a quick-drying patching plaster into a wad of patch material (avoid steel wool, as it will rust) and push the material into the hole (Figure 5). Smooth over the outside so that it will be difficult for the rodent to find a rough edge to gnaw. The inward curve of a rodent’s teeth make it difficult to gnaw a flat, hard surface. When given a rough surface or an edge to bite into, however, they can quickly gnaw into most materials.



Figure 5. Seal holes with rodent-proof materials where pipes, wires, or similar objects enter buildings.

Holes 3 inches or more in diameter should be covered or backed with ¼ inch woven/welded hardware cloth prior to patching. An alternative is a sheet metal patch with a self-adhesive backing. Close openings around augers, pipes, and electric cables using cement mortar, masonry, metal collars, or other appropriate product. For large openings,

recommended materials are concrete (minimum thickness of 2 inches reinforced, or 3¾ inches if not reinforced), galvanized sheet metal (24 gauge or heavier for wall or pipe barriers, 22 gauge or heavier for kick plates or door edging, 14 gauge for perforated or expanded sheet metal grills), brick (3¾ inch thick with joints filled with mortar), hardware cloth (woven, 24 gauge, ¼ x ¼-inch mesh), and aluminum (22 gauge for frames and flashing, 18 gauge for kick plates and guards).

Vents and windows: Use only metal window screening materials to prevent entry. For large openings or where the screen may be subject to abuse, add crossbars to support the hardware cloth.

Vents for heating and air conditioning should be screened if at all possible. To prevent a reduction of airflow, ½ x ½-inch hardware cloth is recommended, although a smaller gauge would be more effective for rodent control. Sometimes, power vents can be covered with hinged metal plates (louvered) that open with air flow and close when the fans are off. However, louvers must fit tightly to be effective at preventing rodent entry.

Exterior doors: Doors should fit tightly and the threshold not exceed ¼ inch. Metal thresholds can be fastened to floors.

Foundations and floors: Gaps or flaws along building exteriors where the wall framing or siding meets the foundation provide easy entry for rodents. Such openings can be prevented by well-formed and finished concrete work and installation of tight wall framing and siding, or installing metal screen-type flashing between the siding and the foundation. Metal siding may provide entry points where panel ends are left open. Use of concrete, plaster, or metal sheeting is effective if properly installed so that all the ribs or corrugations are closed. Rubber or vinyl weather stops are quickly gnawed through. Repair cracks in foundations and floors with concrete or masonry grout. Note that rodents can claw and gnaw at concrete and Portland cement until it is fully cured, so the use of hardware cloth laid in the top ¼ inch of the repair area may be necessary, or provide a rodent-proof overlay until the concrete is

fully cured. As a caution, metal products placed within 1 inch of a concrete surface will oxidize and corrode and may discolor the concrete.

Drains and pipes: Rodents use drainage pipes or sewage systems as routes to enter buildings. Equip floor drains with metal grates held firmly in place, with grate openings not exceeding ¼ inch. Maintain ½ inch hardware cloth over sewer roof vents.

Climbing walls, vertical pipes, or electrical wires: Physical barriers and guards can be constructed to prevent rodents from climbing up walls or at corners of walls. A sheet metal band attached to a wall at least 26 inches above the floor or ground will prevent mice from climbing. This rodent guard should be at least 14 inches but preferably 18 inches wide. A flat guard can be placed on top of a vertical pipe or electrical wire that is attached to a wall. Cone-shaped circular guards can be constructed for placement around free-standing pipes or wires. Use 24-gauge metal and extend the cone out at least 18 inches around the pipe or line. Anchor the cone in place by one or more arms on the side opposite to that accessible to rodents.

Step 3: Population Reduction

Once sanitation practices are in place and rodent-proofing has begun, it is time to concentrate on reducing the number of rodents in the home or building. For moderate or severe infestation, techniques to reduce or eliminate rodents won't solve the problem if rodent populations outside the home or building can gain easy entry. The rodents outside can repopulate those that are removed from inside, thus becoming a never-ending cycle unless rodent-proof measures and sanitation practices are attempted before or simultaneous to population reduction.

Rodent populations can be reduced using traps and/or toxic baits. Generally, baiting is recommended in cases of severe infestation and a quick reduction of rodent numbers is needed. Trapping is recommended when only a few rodents are causing problems and a quick reduction is not necessary.

Traps

Trapping can be effective for controlling a few mice or rats around homes, garages, or small structures. For large infestations, trapping requires more labor and therefore is recommended only in situations where poisons cannot be used. Trapping offers the advantage of being able to dispose of carcasses, rather than dealing with problems associated with odors from irretrievable carcasses that decompose after poisoning. Also, secondary species which consume trapped mice will not perish compared to the risk of a poisoned rodent being found and consumed.

Snap traps: A simple, inexpensive, wood-based snap trap is available in most garden and hardware stores, and if set properly, is 75% to 88% effective in killing rodents. Other designs including plastic or enclosed snap traps can also be effective. Set traps close to walls behind objects in dark places where rodent activity is observed. Place the trap trigger along its runway, which is usually along the base of a wall, so that the rodent will pass directly over the trigger. Place the trigger side of the trap closest to the wall and set another trap beside it to improve your success (Figure 6). If mice or rats remove bait without tripping the trap, glue a square piece of cardboard, metal, or screen wire to the trigger plate, effectively increasing the size of the trigger. When placing multiple trap sets, position them no more than 6 feet apart where rodents are active. Bait traps with peanut butter, or tie securely a small piece of nutmeat, chocolate candy, bacon, or marshmallow to the trigger.



Figure 6. Set two snap traps side-by-side with their triggers closest to the wall where mice frequent.

Photo courtesy of Becky McPeake, UA Cooperative Extension Service.

Multiple-capture traps: Multiple-capture (automatic) mouse traps work on the principle of a one-way door where mice enter but cannot exit and may catch many mice at one location. These can be effective but must be emptied periodically so that mice do not die of starvation or exposure in the traps. Sometimes poison is also incorporated into these traps, which would then be checked frequently and carcasses disposed of. Additional information about these traps is described in the section about toxic baits.

Live box traps: Some wire or box traps (e.g., Sherman traps) are available commercially for live-capture of a rodent where it can be released outdoors, preferably in remote locations away from homes and buildings. Use peanut butter or water as bait set either on or just beyond the trigger.

Glue boards: Glue boards have a strong adhesive which catches and holds rodents attempting to cross them and can be purchased commercially. Home-made glue boards are usually not cost-effective because of the expense of the adhesive. Place glue boards wherever mice travel typically along the base of a wall. Note that mice attempting to free themselves may cause bodily harm to themselves and/or starve. Do not use glue boards where children, pets, or other wildlife can contact them. Glue boards lose their effectiveness in dusty areas unless they are covered, for example with a shoebox having an entry hole.

Toxic Baits

Toxic baits are a type of rodenticide that mice or rats consume in an attractant which masks a lethal dose of an active ingredient. Children, pets, and wildlife can be poisoned directly through consuming toxic bait. Pets and wildlife can be poisoned indirectly through consuming poisoned carcasses or living rodents that have not yet succumbed to the toxin. Toxic baits provide only short-term control for rodents when sanitation practices, habitat reduction, and rodent-proofing are ignored. Therefore applying rodenticides is recommended as part of a three-step plan where large infestations of rodents occur.

Table 1. Types of rodenticide bait stations available for consumer use from lowest (Tier 4) to highest (Tier 1) level of resistance.

Bait Station Capabilities	Level of Resistance			
	Tier 4	Tier 3	Tier 2	Tier 1
Resistant to children	No	Yes	Yes	Yes
Resistant to pets (dogs)	No	No	Yes	Yes
Resistant to outdoor weather	No	No	No	Yes
Resistant to indoor conditions	Yes	Yes	Yes	Yes

Recent changes to rodenticide regulations limit the availability of toxic baits for home use. Bait stations (Table 1) which cover the toxicant not only improve safety of bait application but may also improve its effectiveness. Bait stations provide rodents a protected place to feed, allowing them to feel more secure and consume more bait. Rodents are color-blind; therefore, for safety reasons, baits can be dyed distinctive colors without causing avoidance. When choosing a bait station for household use, consider these options:

- Non-refillable or refillable bait. Non-refillable bait stations cannot be opened and are to be discarded as indicated on the label after bait is consumed or contaminated. Refillable bait stations can be opened and additional bait purchased for refilling.
- Time to death. Some bait station houses are designed for the rodent to enter the station, eat the bait, and leave before dying. Consider where mice or rats are living and the possibility of creating a foul odor as the animal dies within walls or other inaccessible locations.
- Indoor or outdoor use. Weather-resistant bait stations for outdoor use can be used within 50 feet of buildings.
- Tamper resistant. Some bait stations are not tamper-resistant and can be accessed by young children and pets. If a bait station is not tamper-resistant, use only indoors in residences where no young children and pets live or visit.

Rodenticides have different active ingredients, classifications, modes of death, and availability (Table 2). Availability of baits depends in part on its active ingredient. Baits containing first-generation anticoagulants must be sold in 4-pound containers. Products containing second-generation anticoagulants must be sold in containers holding at least 16 pounds of bait for use by commercial certified applicators and at least 8 pounds of bait for agricultural use.

Some rodenticide baits are Restricted Use Pesticides and are available only to licensed commercial pesticide or agriculture applicators. Users of restricted use products, so deemed by the U.S. Environmental Protection Agency, must first obtain a license from the Arkansas Plant Board. An eligible private applicator must be a producer of an agriculture commodity and is required to attend pesticide safety training provided by the University of Arkansas Cooperative Extension Service. The license is not available to homeowners or home gardeners. Commercial applicators are licensed to use restricted pesticides by taking and passing the required exams. All applicators of Restricted Use Pesticides must meet the retraining requirements (recertification) in order to maintain their license. Recertification is required every 5 years for private and every 3 years for commercial applicators. Recertification covers all aspects of the proper handling of restricted use pesticides. Agriculture producers who obtain licenses are allowed to use Restricted Use Pesticides to control rats and mice in or within 100 feet of buildings or other structures for agriculture purposes.

Table 2. Active ingredients in Arkansas-registered rodenticide baits and availability, 2017.

Common Name	Classification	Days Feeding (Dose) and Time to Death	Availability	
			Consumer	Restricted Use
Brodifacoum	Second-generation anticoagulant	Single, 4 – 5 days	X	
Bromadiolone	Second-generation anticoagulant	Single, 5 – 8 days	X	
Bromethalin	Non-anticoagulant, neurotoxin	Single, 2 – 4 days	X	
Chlorophacinone	First-generation anticoagulant	Multiple, 3 days or more	X	X
Cholecalciferol (Vitamin D ₃)	Non-anticoagulant, acute kidney failure	Single or multiple, 3 – 4 days	X	
Difenacoum	Second-generation anticoagulant	Single, 3 – 23 days	X	
Difethialone x	Second-generation anticoagulant	Multiple, 2 – 10 days	X	
Diphacinone	First-generation anticoagulant	Multiple, 3 days or more	X	X
Warfarin	First-generation anticoagulant	Multiple, up to 7 days	X	

Rodents poisoned with anticoagulants die from bleeding internally. A few cases of pet and wildlife poisoning have been reported when feeding on dead rodents. However, anticoagulants are considered safer rodenticides because typically multiple doses are necessary to poison humans or pets. Some have a simple antidote of Vitamin K₁.

Sometimes rodents may ingest baits with no results, or reject baits altogether. In situations with moderate to severe infestation, check for differences in bait acceptance among several bait types prior to investing time and money in a specific bait product. Other reasons for failure of baits are:

- Too short a period of bait exposure. Continue replenishing bait until no more is consumed.
- Insufficient bait and insufficient replenishment of bait. Make sure plenty of fresh, clean bait

is available for rodents to receive a sufficient dosage.

- Too few bait stations and/or too far apart. For mice, stations should be within 6 feet of each other in areas where mice are active. Further distances can be used for rats. The more severe the infestation, the more bait stations are required.
- Rodents moving in from untreated areas, e.g., your neighbors. Rodent-proof the structure to prevent additional rodents from moving in.
- Abundance of other food choices. Try restricting food choices by removing bird feeders, dog food, fruit falling from trees, etc., and placing food in metal containers to restrict access; baiting at a time of year when fewer food choices are available; or using different baits. Rodents may be rejecting a bait product simply because the bait does not taste as good as other available foods.

- Tainted bait – bait has become moldy, rancid, insect-infested, or contaminated. Replace with fresh bait.

Proper placement of bait stations is just as important as using the appropriate bait. Rodents will not visit bait stations if they are located in areas with no rodent activity. Take the bait to the rodent – not the reverse. When possible, place bait stations between the rodents' source of shelter and their food supply. Put bait stations near burrows, against walls, or along travel routes (Figure 7). Look for signs of activity such as droppings, gnawings, tracks, and rub marks. For bait stations with refillable bait, inspect daily and replenish eaten bait. If bait becomes moldy, musty, soiled, or insect-infested, empty the bait station, clean it, and refill with fresh bait as rodents will reject soiled or stale bait foods.



Figure 7. A properly placed bait station is more likely to be visited by rats. Photo courtesy of Becky McPeake, UA Cooperative Extension Service.

Whenever a rodenticide is used, safety must be the first consideration. **Always follow label directions when using rodenticides.**

- Always store away from children and pets, such as in a locked utility cabinet or garden shed.
- Place baits for rodents only in locations where children and pets cannot access them.
- Never store pesticides next to food, including pet food.

- To prevent accidental poisoning of wildlife and pets that might eat a dead animal, promptly remove and dispose of carcasses of dead rodents.

Certain general safety precautions should be observed in addition to those appearing on labels of specific rodenticide products.

- Wear gloves and possibly protective eyewear when handling baits and bait stations.
- People handling baits should neither smoke, eat, drink, nor put their hands near their mouth while cleaning or disposing of bait stations.
- For refillable stations, set aside old bait. Spray interior with any common disinfectant or 10% bleach solution, being sure to dampen any droppings. Let dry. Then empty contents into a plastic bag and dispose of according to the label. Use a brush to clean residues. Refill station with fresh bait. Dispose of gloves and wash hands and brush well using soap and plenty of water. Use the same brush for the next cleaning, or discard.
- After completing a poisoning program, pick up all dead rodents. Handle the rodent carcass using rubber gloves or a pair of long tongs, place in plastic bag, close tightly, and put in secured garbage can.
- Label all bait containers or stations, unused baits, and rodenticide concentrates with an appropriate warning. Store unused bait away from children, preferably in a locked place. Restrict access to authorized, responsible individuals.

Tracking powder: The concentration of an active ingredient in tracking powders is considerably higher than food baits using the same toxicant, and therefore powders are more hazardous. For example, the active ingredient in chlorophacinone is non-restricted at 0.005% but restricted when 0.2% of the

product. Tracking powders are a restricted use pesticide primarily for certain agricultural situations around warehouses or feedlots. When rodent food is plentiful and good bait acceptance is difficult to achieve, tracking powder may be the only alternative. When rodents walk over a patch of toxic powder with zinc phosphide, they pick up some on their feet and fur and later ingest it while grooming. Only one dose is necessary. Their stomach acid turns the chemical into a toxic gas. Note that other animals can become poisoned from consuming rodent carcasses with tracking powders, and therefore carcasses should be retrieved and disposed of in a safe manner.

Predators

Predators can be effective at helping prevent an infestation of rodents, but less so at reducing an infestation. Examples of predators are dogs, cats, and wild animals including hawks, owls, coyotes, foxes, bobcats, roadrunners, and snakes. Clearing brush and hiding places for rodents may help expose them to predation along with other control methods, but rarely is biological control alone adequate for conquering an infestation. In the natural world, the predator-prey ecological theory implies predators are unable to remove enough prey to affect the prey population until future generations are able to assist with the effort. The result is a cycle whereby predator and prey populations shadow each other. Another option is allowing an overabundant rodent population to crash when food becomes unavailable. Reasonably so, most people are unwilling to wait until that point for a biological response to occur.

Domestic dogs and cats may help somewhat with rodent control. Dogs and cats are better able to catch and kill an occasional invading rodent which is unfamiliar with escape routes. Cats are very effective predators of mice but usually will not attack an adult rat. Releasing cats outdoors to reduce rodents, even neutered or spayed cats, is not recommended. Feral cats will prey on species other than rodents such as songbirds and other native wildlife.

What Isn't Recommended

Frightening devices producing ultrasonic sounds are commercially available, but their effectiveness is unsubstantiated by scientific research. Loud or unusual noises may temporarily frighten rodents, but they soon become accustomed to new sounds heard repeatedly.

Repellents such as mothballs or household ammonia may temporarily move rodents from one location to another but do nothing to remove them. Additionally, some people are allergic to naphthalene, the active ingredient in moth balls, so caution is advised. A product called Ro-pel is registered for use in repelling rodents from gnawing on trees, poles, fences, garbage, and other objects but will do nothing to remove rodents.

Fumigants typically are not an option in homes. Some fumigants are registered for use in rodent burrows; however, house mice burrows are often small and difficult to find and therefore cannot be fumigated efficiently or economically. Norway rat burrows may be visible, but fumigants often leach into the soil and have little effect on burrowing animals.

Concluding Remarks

An effective rodent control program can be achieved through a combination of sanitation practices and habitat modification, rodent-proofing, and population reduction. In areas with moderate to severe infestation, a cooperative effort among adjoining properties will be necessary to achieve long-term, effective rodent control measures. Otherwise, rodents from surrounding habitats can be expected to “fill the void” and return to the unoccupied rodent habitat in the home. Many commercial products are available for rodent-proofing homes, and trapping and baiting rodents. Toxic baits pose a risk to the handler, children, pets, and non-target wildlife species. Safety considerations should be a priority when using toxic baits.

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Disclaimer

The mention of a trade name in this publication or use of a photograph which includes a trade name or shows a commercial product does not imply endorsement by the University of Arkansas System Division of Agriculture, Cooperative Extension Service. Use of trade names is intended to provide clarity and does not imply discrimination against other products or firms. Because of product turnover, information presented in this publication may become outdated. Always follow the pesticide label when applying baiting practices.

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About the Author

REBECCA McPEAKE is a professor and Extension wildlife specialist with the Forest Resources Center, University of Arkansas System Division of Agriculture, and is located at the State Cooperative Extension Service headquarters in Little Rock.

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