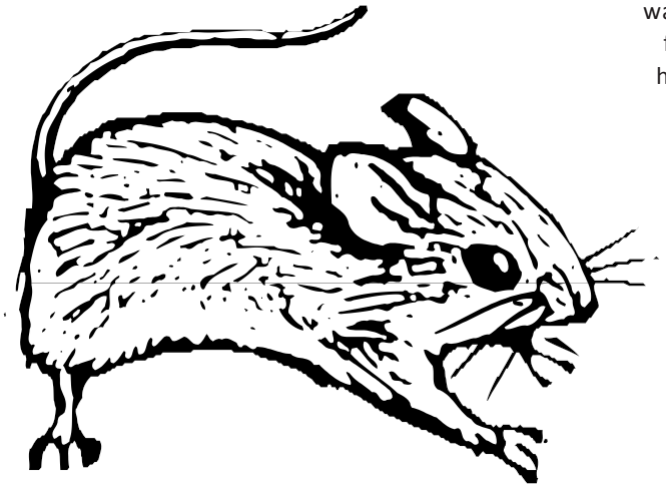
Minimizing Mouse Madness

A Guide to House Mouse Control

by Becky Crouse

A friend of mine had a pet mouse named Nickodemus. We would take him out of his cage and pet him, and let him run up and down our arms. Unfortunately, my friend's mom didn't find him so endearing. You know that "EEK!" heard in every cartoon featuring a rodent? People really do that. Poor Nickodemus was given up for adoption. Now, having awoken to something scurrying across my bed, and having found a fuzzy friend in my kitchen, I understand that it's more than a little unnerving, but I also know it's inevitable. Mice are attracted to places that provide hiding places and easy-to-access food. You are going to find them anywhere humans live, and mice have been found everywhere from penthouse apartments and upscale restaurants, to low-income neighborhoods and fast-food joints. Now, combine this food and shelter with the onset of cold weather, and suddenly you have more roommates than you ever thought possible. They're warm blooded, and they don't have a fireplace in their den. (Unless, of course, your den has become their den.) They are going to want in, and they're incredibly resourceful in their pursuit of a warm, cozy home – yours.



Can I see some ID?

The house mouse's body is brown to gray, about 3 to 4 inches long, and weighs only about ½ ounce. It has a semi-naked, dark tail about the length of its head and body combined, large ears and eyes in proportion to its head, and a pointed snout. Its upper incisors are flat and notched, and its feces are rod shaped, pointed at the ends, and about ¼ inch long.

They're multiplying!

One pair of house mice can, in theory, produce 87 young per year. The female becomes sexually mature at two- to three-months old, and is sexually receptive and fertile (estrus) every four days throughout the year, but will mate at any time. Her gestation period is 20 days, and her average-sized litter is 6.7 cute, cuddly, little newborns. She can produce, depending on the availability of food, up to 10 litters per year. Mouse populations will grow as large as their food, shelter, and other competing species will allow. No matter what method of control you choose, the only way to permanently rid yourself of a mouse problem is to remove their access to the food and shelter that you are providing.

Keeping them out.

The first defense and offense should always be prevention. A full-grown mouse can enter your house through a hole the size of a dime. They are talented climbers and able to swim, but do not need water to survive. (They get water from their food.) To minimize your house mouse magnetism:

Outside

- Stuff holes in and around the house with steel wool or copper mesh, or fill them with caulk or plaster and cover with sheet metal. Pay particular attention to the foundation and holes between the house and garage;
- Seal gaps around the doors by replacing worn thresholds and weatherstripping, and installing door sweeps;
- Raise woodpiles at least 12 inches from the ground (and pet cages, if mice find them interesting), and wrap the legs in galvanized sheet metal to prevent the mice from climbing them;
- Cut tall grass, weeds, and brush from around the foundation and dispose of the clippings;
- Discard or recycle unused clutter around the house that may be providing a home for mice;
- Pick up fallen fruit and rotting vegetables from the garden, and don't place food scraps at the top of the compost pile;
- Store birdseed in a sealed container, use a birdfeeder with a catch tray, and clean up around it regularly; and,
- Store trash in a metal container with a tight cover or fastener for the lid.

Inside

- Don't leave food on counters or dirty dishes in the sink overnight;

- Keep the stovetop, oven, broiler, and kitchen floor clean (especially under the stove and refrigerator);
- Keep the garbage in a plastic container with tight lid;
- Store grains, cereals, nuts, and pet foods in sealed plastic, metal or glass containers, or keep them in the refrigerator;
- Pick up any uneaten pet food before going to bed;
- Caulk openings around water pipes, electric wires, cables, and vents; and,
- Use hardware cloth to screen vents, floor drains, and any other openings.

How will I know?

A mouse scurries across the linoleum while you're contemplating your midnight snack, you find droppings on the counter or find a bag of barley with holes on both ends and a tunnel running between – it may be this easy to determine that you have a mouse problem. If you aren't certain that Mickey's cousins have moved in, sprinkle the surface that you sus- pect that they are frequenting with a light coating of flour. If correct, you'll find footprints in the flour and tracks from the flour, hopefully, to their point of entrance.

Be more aware of possible mouse activity in the fall, when the cold weather hits, paying particular attention to areas where food is stored. Watch for mouse activity outdoors, in areas adjacent to houses, which may be the first sign of an impending onslaught.

They're here!

There are a couple of tactics that you can employ to rid yourself of your uninvited guests:

Physical controls:

HAVE-A-HEART TRAPS. These "live" traps are meant to capture the mice so that you can release them instead of killing them. They are usually metal mesh with doors at either end. You can find this type of trap at your local hardware store, or contact Beyond Pesticides/NCAMP for a list of resources. Just be sure to release your little live friend far enough away from your house that he won't return, and remember to block off his point of entry to prevent any of his friends from taking up residence in his absence.

SNAP TRAPS. If you use snap traps, purchase traps that have expanded triggers that snap when a mouse runs over them, even when unbaited, and a clothespin-like closing mechanism, which is thin enough to allow the bait pan to be bent by hand, allowing for the regulation of trigger sensitiv- ity. Your chances of catching your mouse are greater with a more sensitive trigger.

Set baited traps out for a few days without setting the triggers, as mice are wary of new objects in their environment. You will also have a chance to see if your bait is disappearing, indicating that you have chosen a good location for your traps and bait that your mice enjoy. If there is no sign that your bait has been eaten, move your traps to a new location. If that doesn't work, then change your bait.

Mice tend to scurry along the walls, often referred to as runways. Traps should be positioned at a right angle to the wall, with the bait end towards the wall. Place five to ten traps near mouse holes, one to two feet apart. If you are the lucky host to a multitude of mice, it is more likely that they will approach from more than two directions. Try setting the traps in pairs parallel to the wall, with bait pans facing outwards. Traps should always be handled with gloves, as mice are sen- sitive to the odor of humans. Coating the trap with bacon grease will also help to mask your scent.

Bait should be sticky so that the mouse will disturb the trigger mechanism even if it only touches the bait lightly. Good choices include peanut butter mixed with rolled oats, raisins, gum drops, or even a small piece of cotton that your little friends will attempt to acquire for nesting material. Various baked breads have also had great success rates, with trap shyness minimized by alternating the type of bread used.

GLUE TRAPS. Many people object to glue traps because they don't kill the mouse immediately and may trap non-target species. The Center for Disease Control cautions against the use because urine that may be excreted from a frightened mouse can spread germs. A mouse that does die in the trap can contain pathogens that are also a health hazard. Another problem with the glue traps is what to do with the living mouse once it has been caught. Traps need to be checked at least once daily and, once trapped, must be killed quickly and humanely. The American Veterinary Medical Association (AVMA) has a guide on acceptable euthanasia and

Mouse populations will grow as large as their resources will allow.

has denounced sticky traps, unless it is required for pest control. Though it is sometimes suggested by trap manufacturers, drowning is explicitly illegal in many jurisdictions. For these reasons, many animal welfare groups and individuals have identified this as an unacceptable measure for mice control.

However, in the case of very large infestations, sticky traps may be a suitable option after other methods—including exclusion, sanitation and other traps—have been exhausted. They are good for hard-to-reach places or where it is difficult to gain access to mouse runways. Before using any product, it is important to be informed of the potential hazards and cruelty associated with its use. As with any method of trapping, be sure to prevent children, pets or other non-target species from getting hurt or exposed to nasty pathogens from the dead and live mice.

REPELLENT SOUND DEVICES. Certain devices disrupt the sound communication between mice and repel rodents by generating a sound that annoys them, but at a frequency that is not heard by humans. There is little scientific proof that this is an effective method of control, though there have been reports of success. One example is a solid-state electronic unit that uses a patented method of directing variable pulsating frequencies onto a carrier, usually either the electrical wiring of a building, the metal gridwork within a building or the earth around the building, depending on where the unit is used. In your home, it would plug into a three-pronged electrical outlet and use the building's existing wiring to carry a variable, pulsating frequency that would distress your mouse visitors, causing them to leave. This system is designed to affect mice no matter where they are, between walls, in ceilings, and below floors. It is best used with another method of control for the first few months during the "flushing out" period, and when accompanied by habitat modification.

The first defense and offense should always be prevention.

Biological controls:

CATS. Think you're immune to mice because you have a cat? Think again. Cats may be effective in knocking off the occasional mouse, but it is unlikely that they will be capable of suppressing an established mouse problem. If you decide to get a cat, females are more predacious than males, especially if they have a new litter or have been trained by a good mouser. Only count on your cat to prevent initial mouse entry or to detect and remove new mouse colonizers, and remember that, in the small amount of time it lives in your house, a mouse may have time to contaminate food, destroy furnishings, or spread pathogens over clean dishes.

OTHER BIOLOGICAL CONTROLS. Outside, the mouse has many natural enemies, including native hawks, owls, snakes, mites, ticks, fleas, flies, nematodes, bacteria, and viruses. Maintaining parks with wild areas within urban settings can encourage these beneficial organisms.

Specific strains of *Typhtmurium*-like salmonella bacteria are used to control outbreaks of small field rodents in Russia. This is not, however, a practical resource for consumers.

Chemical Controls:

You have options in the world of chemical mouse control — rodenticides (baits and tracking powders) and bait boxes. Mice nibble rather than eat large quantities at a time, so any rodenticide that you consider will need to be used at high concentrations, which means an increase in the hazards to nontarget species (like your pets and kids) who inadvertently happen upon your pile o' poison. If you decide to use poisons, be sure to block off the areas where you have placed them to minimize the chance of an accident.

TRACKING POWDERS AND SINGLE-DOSE BAITS: Tracking powders are extremely hazardous and should really be left to a professional pest control operator. Single-dose baits are high-concentration poisons. They are restricted materials that require a permit and can only be applied by professionals.

ANTICOAGULANTS: The most commonly used household rodenticides are multiple-dose anticoagulant baits. These chemicals are ingested in smaller doses over several days, and essentially work by preventing the mouse's blood from clotting, causing it to bleed to death internally. There is still some risk of poisoning nontarget species, even with the lower doses of poison, and are also reports of mice becoming resistant to some of the most common of the anticoagulants — warfarin, chlorophacinone, bridufaciynm and broma-diolone. *(See our rodenticide fact sheet on pages 13-14 for more information.)*

BAIT BOXES: Bait boxes are plastic or metal boxes with the anticoagulant bait placed inside. The bait is protected from the elements, humans and pets are more protected from unintentional exposure to the bait, and the amount of bait being taken by the mice can be more carefully monitored. Bait boxes may also help increase the amount of food (and, with the food, poison) taken in by the mouse. Contact Beyond Pesticides/NCAMP for a list of resources for bait boxes.

It is extremely important to try and prevent a mouse problem before it occurs. If you have gone through the steps of prevention and still find yourself the host to mouse guests, begin utilizing your control method of choice as soon as you see signs of mouse activity. It is possible to prevent an infestation from occurring, but remember, no method is going to be a permanent fix unless you seal them out of your house and remove their access to your food.

Contact Beyond Pesticides/NCAMP for more information about house mouse control and a listing of physical control resources ($4 ppd).

Resource:

Olkowski, Helga, Daar, Shiela, and Olkowski, William. 1991. *Common –Sense Pest Control*. Newtown: The Taunton Press, Inc.

RODENTICIDES

Rodenticides, pesticides specially designed to kill rodents, pose particular risks for accidental poisoning for several reasons. Since they have been designed to kill mammals, they are also toxic to humans. Because rodents usually share human environments, use of rodenticides poses an inherent risk of exposure to people, particularly children and their pets, as well as other non-target species. In addition, as rodents have developed resistance to these chemicals, there continues to be a need to develop new and potentially more toxic rodenticides.[1]

What are Rodenticides?

Rodenticides can be broken down into three categories, baits, tracking powders and fumigants. Both baits and tracking powders are rodent poisons in the traditional sense, they must be eaten to kill the pest. Baits are designed to attract the rodent to a feeding station. Baits can be used both in the field and in and around buildings. Tracking powders are placed along rodent runways in and around buildings, picked up by the fur as the animal passes by, and then ingested during grooming. Fumigants are poisonous gasses, designed to kill rodents in their burrows.

Rodenticide baits and tracking powders are the type of rodenticides that are most often encountered by homeowners with a rodent problem. There are two types of rodent poisons generally available – acute poisons (also known as single feed baits) and chronic poisons (multiple feed baits).[2] Acute poisons are extremely dangerous to pets and children, as one encounter can make them very sick or kill them.[3]

Multiple feed baits are the most commonly used type of rodent poisons. Typically these poisons act as anti-coagulants, literally causing the victim to bleed to death internally. The fact that these poisons must be made available to the pest animal over time makes them very hazardous as children, pets and other non-target animals have an extended opportunity to get into them. Current labels for rat and mouse baits used outdoors require that baits be applied in protective, tamper proof bait stations or placed in areas inaccessible to non-target wildlife.[4]

Classes of Baits

ANTI-COAGULANTS

There are two classes of anti-coagulant type rodent poisons, the courmarins and the indandiones. Courmarins include some very common rodent poisons such as warfarin, bromadiolone, and courmafuryl. Indandiones include the rodent poisons diphacionone and chlorophacinone.[5]

Both of these classes of toxic materials work by blocking vitamin K-dependent synthesis of the blood clotting substance prothrombin. Animals suffering from exposure to anti-coagulant rodenticides suffer from the following list of immediate toxic effects: nosebleeds, bleeding gums, blood in urine and feces; bruises due to ruptured blood vessels; and skin damage.[6]

Exposure to these poisons also has long-term health effects. The courmarin, warfarin, for example, has been shown to cause paralysis due to cerebral hemorrhage[7] and is teratogenic[8] (causes birth defects). Long-term exposure to the indandione, diphacinone causes nerve[9], heart, liver, and kidney damage as well as damage to skeletal muscles.[10]

CHOLECALCIFEROL

Also known as vitamin D_3, cholecalciferol has a unique mode of action. It is metabolized by the body into its active form, which increases the absorption of calcium and phosphorus from the gut, resulting in very high serum levels of calcium.[11] The prolonged hypercalcemia is delayed in onset and insidious in progression, leading ultimately to the death of the victim.[12]

BROMETHALIN

Bromethalin is a neurotoxin, unlike the other rodent poisons. The poison affects the body's ability to control muscle contraction through uncoupling oxidative phosphorylation. It can cause swelling of the brain, spinal column and nerves, leading to a loss of the myelin nerve sheath and ultimately to a reduction of nerve impulses and death.[13] Immediate effects of exposure to bromethalin include skin and eye irritation, weakness in legs, loss of tactile sensation, and death by respiratory arrest.[14]

ZINC PHOSPHIDE

When zinc phosphide is ingested, it reacts with water and stomach juices to release phosphine gas, which can enter the blood stream and affect the lungs, liver, kidneys, heart and central nervous system. It is easily absorbed through skin or inhaled from fumes. With repeated exposure, it accumulates in the body to dangerous levels.[15]

Signs and symptoms of mild zinc phosphide poisoning include diarrhea and stomach pains. In more severe cases, nausea, vomiting, chest tightness, excitement, coldness, unconsciousness, coma and death can occur from pulmonary edema and liver damage.

Table 1. Demographic Profile of Exposure Cases to Rodenticides in 1998

SUBSTANCE	NO. OF EXPOSURES	AGE			REASON		TREATED BY DOC.	OUTCOME		
		<6	6-19	>19	Unintent	Other		Mod	Maj	Death
Anti-coagulants	17,724	15,854	561	1,146	17,029	654	5,882	72	28	1
Strychnine	186	35	20	113	97	78	99	15	5	3
Other/unknown	2,390	1,719	158	434	2,156	219	917	35	6	1
Totals	20,300	17,608	739	1,693	19,282	951	6,898	122	39	5

From: Litovit, T.L., et al. 1999. 1998 Annual Report of the American Association of Poison Control Centers Toxic Exposure Surveillance System. *American Journal of Emergency Medicine* 17(5). <http://www.aapcc.org/1998.htm>

STRYCHNINE

Strychnine causes violent convulsions because of its direct action on the central nervous system, chiefly the spinal cord. The onset of symptoms begins usually within 15 to 20 minutes of ingestion. A lethal dose of this natural toxin is as little as 15 mg in children.[16]

Immediate effects of exposure are irritation to the upper respiratory tract and skin, vomiting, convulsions, hyperthermia, and death due to respiratory or cardiovascular failure.[17] Victims of strychnine poisoning should be placed in a warm, dark room in order to reduce the stimuli that can trigger convulsions. Medical help should be brought to the victim rather than transporting the victim to the medical center because movement will trigger convulsions.[18]

Table 2. Ounces of Rodenticide Bait LD50s for Pets.

RODENTICIDE	DOG 10 LBS.	DOG 22 LBS.	DOG 30 LBS.	CAT 4.4 LBS.
Warfarin	13	28	38	8
Bromadiolone	35	77	105	35
Diphacinone	3	6	8	7
Chlorophacinone	160	353	481	-
Cholecalciferol	19	42	57	-
Bromethalin	8	16	22	1
Zinc phosphide	0.16	0.35	0.48	0.06

From: 1998. Rodenticide Risk to Dogs and Cats. *Techletter: For Pest Control Technicians* 4(23).

Classes of Fumigants

Fumigants are used to kill rodents in their burrows. As a result, homeowners are much less likely to encounter the use of these chemicals but they are worthy of mention. The two most commonly used gasses to kill rodents are phosphine gas and methyl bromide.

PHOSPHINE GAS

Available in a variety of forms including aluminum phosphide and magnesium phosphide, phosphine gas is extremely toxic. Accordingly, EPA has placed chemicals that produce phosphine gas in toxicity category I, the highest toxicity category.[19]

When aluminum phosphide is dropped into a rodent burrow it reacts with moisture to form phosphine gas. The signs and symptoms of exposure to phosphine gas are described above under zinc phosphide.

METHYL BROMIDE

Methyl bromide has also been placed in EPA's toxicity category I. EPA has expressed concern over methyl bromide's potential to destroy ozone.[20] As a result, methyl bromide is scheduled to be phased out by 2005,[21] although there is political pressure to extend or reopen the phase out. Long-term exposure studies have found that methyl bromide is a mutagen, and neurotoxin that causes liver and kidney damage.[22]

RODENTICIDE RISK TO HUMANS AND PETS

Rodenticides rank second in the number of human exposures each year compared with the three other major categories of pesticides for which data is collected by the American Association of Poison Control Centers (AAPCC) (see table 1). According to AAPCC's latest numbers, 20,300 people were exposed to rodenticides in 1998. As mentioned above, anti-coagulant poisonings make up the vast majority of cases with 17,724 (87% of total) reported cases. Young children are the most common victims of exposure to rodenticides, 17,608 cases of exposure (87%) were children under six years of age; that is over seven times higher than the other two age groups combined. Tragically, five people died as a result of their exposure to rodenticides in 1998.

Pets and non-target wildlife also fall victim to exposure to rodenticides. Exposure to these animals can occur as a result of either feeding on the bait or eating rodents that have been killed by rodenticides. Toxicologists calculate the dose of poisons that will kill 50% of the animals that are exposed; this measurement is called an LD_{50}. It takes as little as 0.16 ounces of zinc phosphide to kill a 10 lb. dog (see table 2). Rodent poisons should be used only as a last resort. If poisons are used, homeowners need to practice extreme caution when choosing to control rodents in this way.

People dealing with a rodent problem need to consider all of the alternative, nontoxic approaches to rodent control. *See pages 10-12 or contact Beyond Pesticides/NCAMP to find out more about nontoxic approaches to rodent control.*

RODENTICIDES ChemicalWATCH Fact Sheet References

[1] Fishel, F. and P. Andre, 1999. "Pesticide Poisoning Symptoms and First Aid." University of Missouri Agricultural Engineering. <http://muextension.missouri.edu/xplor/agguides/agengin/g01915.htm>

[2] Simon, L. and W. Quarles, 1996. "Integrated Rat Management," *Common Sense Pest Control* 12(1):5-15, citing Meehan, A.P. 1984. *Rats and Mice: Their Biology and Control.* Rentokil, East Grinstead, West Sussex, United Kingdom.

[3] Ibid.

[4] U.S. EPA. 1998. *R.E.D. Facts: Rodenticide Cluster.* EPA-738-F-98-004. p. 2. <http://www.epa.gov/oppsrrd1/REDs/factsheets/2100fact.pdf>

[5] Rachel Carson Council. 1992. *Basic Guide to Pesticides: Their Characteristics and Hazards.* Taylor & Francis, Washington, DC.

[6] Ibid.

[7] Ibid.

[8] Extension Toxicology Network (ETN). 1995. "Warfarin." *Pesticide Information Profiles.* <http://ace.orst.edu/cgi-bin/mfs/01/pips/warfarin.htm>

[9] Rachel Carson Council. 1992.

[10] Extension Toxicology Network (ETN). 1995. "Diphacinone." *Pesticide Information Profiles.* <http://ace.orst.edu/cgi-bin/mfs/01/pips/diphacin.htm>

[11] Craigmill, A. 1998. Veterinary Toxicology Notes: Hazards of New Rodenticides to Pets. *UC Davis Env. Tox. Newsletter* 8(2). <http://ace.orst.edu/cgi-bin/mfs/01/newsletters/n82_88.htm>

[12] Ibid.

[13] Rachel Carson Council. 1992.

[14] Ibid.

[15] Schulze, L.D., et al. 1997. "Signs and Symptoms of Pesticide Poisoning." University of Nebraska Cooperative Extension EC97-2505-A. < http://www.ianr.unl.edu/pubs/pesticides/ec2505.htm>

[16] Fishel, F. and P. Andre, 1999.

[17] Rachel Carson Council. 1992.

[18] Schulze, L.D., et al. 1997.

[19] Extension Toxicology Network (ETN). "Aluminum Phosphide." *Pesticide Information Profiles.* <http://ace.orst.edu/cgi-bin/mfs/01/pips/alumphos.htm>

[20] Extension Toxicology Network (ETN). 1996. "Methyl bromide: Bromomethane." *Pesticide Information Profiles.* < http://ace.orst.edu/cgi-bin/mfs/01/pips/methylbr.htm>

[21] U.S. EPA Methyl Bromide Phase Out Web Site. < http://www.epa.gov/spdpublc/mbr/>

[22] Rachel Carson Council. 1992.