



House Mouse

Integrated Pest Management for Home Gardeners and Landscape Professionals

House mice (*Mus musculus*) are very adaptable animals, existing in many habitat types all over the world. They often live near people and can be found in and around homes, schools, and commercial settings like food facilities and restaurants. In agricultural areas, house mice are generally associated with taller vegetation and less bare ground like hedgerows. House mice consume and contaminate food meant for people, pets, livestock, or other animals. In addition, they cause damage to structures and property, and can transmit pathogens that cause diseases.

Native to Central Asia, the house mouse arrived in North America on ships with settlers from Europe and other points of origin. They have a strong association with people because of our habit of storing their preferred food sources—cereals and grains.

IDENTIFICATION AND BIOLOGY

House mice are small rodents with relatively large ears and small, black eyes (Figure 1). They weigh about ½ ounce and usually are light brownish to gray. An adult house mouse is about 5 to 7 inches long, including the 3- to 4-inch tail.

House mice are sometimes confused with other small rodents found in and around buildings, such as the deer mouse and its relatives (*Peromyscus* spp.; Figure 2), voles (*Microtus* spp.), and shrews (*Blarina* spp.). The house mouse is distinguished from the deer mouse by its overall gray coat. The deer mouse has larger eyes and a white underside with a distinct line of demarcation between the dark coloration on top and the white underside. In addition, the tail on the house mouse has almost no fur on it, whereas the tail of the deer mouse is moderately to well furred and is light underneath and dark on top.

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Figure 1. Adult house mouse, *Mus musculus*.



Figure 2. The deer mouse is sometimes found in homes and outbuildings.

For additional information on deer mice, see *Pest Notes: Deer Mouse* listed in **References**. Common species of voles have short tails, whereas shrews have pointed snouts and tiny eyes.

Droppings and gnaw marks can reveal house mouse activity, and though more difficult to find, tracks or footprints can also indicate their presence. House mouse nests are built in sheltered locations and made from finely shredded paper or other fibrous material. House mice have a characteristic musky odor that is common in large or long-term infestations. House mice are active mostly at night, but they can be seen occasionally during daylight hours—they are active at times when food is available.

House mice eat up to 20% of their body weight daily. They consume food in about 200 small meals each night, which is how they earned the reputation of being nibblers. They can consume food at the source or carry it away to eat in a more secluded setting. House mice are omnivorous, and they eat whatever food is available. They can eat cereals, grasses, roots, seeds, and even insect larvae. House mice do not need to drink water to survive but will seek liquids if they are not getting sufficient moisture from their food, or if there are additional requirements from living in a hot or dry environment.

When house mice have plentiful and stable resources, they can reproduce year-round, resulting in high population densities that last for months to years. This is due, in part, to the high reproductive potential of house mice. In a single year, a female may have 5 to 10 litters of about 5 or 6 pups each, with litter size increasing in older females. Young are born 18 to 21 days after conception, and house mice are sexually mature 5 to 6 weeks after birth, although this can be delayed until as late as 12 weeks. The life span of a house mouse is usually 9 to 12 months, but some house mice have lived up to 3 years. The main cause of death are disease, predation, human

management, climate-related challenges, and starvation.

House mice have keen senses of taste, hearing, smell, and touch, and they can detect movement at least 15 feet away. They are excellent climbers and can run up any rough vertical surface. They will run horizontally along wire cables or ropes and can jump up to 12 inches from the floor onto a flat surface. House mice can squeeze under gaps $\frac{1}{4}$ inch tall, and through openings $\frac{3}{8}$ inch wide. Where outdoor populations of house mice exist, they frequently enter homes in autumn when nighttime temperatures become colder. In commercial facilities, house mice are often directly introduced on or within packaged goods, or from delivery vehicles.

DAMAGE

House mice can cause damage to structures and vehicles by gnawing on electrical wires and gas lines. They can chew on the cords of appliances as well as wires in walls. Many fires of unknown origin are believed to be caused by rodents gnawing on wires.

House mice can contaminate and consume foodstuff that are intended for humans, pets, and livestock. They can chew on storage containers that are intended to protect foodstuff from rodents and leave their feces in food, making it unsafe for consumption.

House mice carry several diseases such as leptospirosis, salmonella, and lymphocytic choriomeningitis (LCM). LCM is a viral disease that is contracted from exposure to fresh urine, droppings, saliva, or nesting materials from infected house mice. It is estimated that 5% of house mice throughout the United States carry and are able to transmit the LCM virus. This viral incidence has shown to be higher in some cities. House mouse urine is a major source of allergens. Exposure to house mouse urinary proteins has been linked to early onset of asthma in sensitive children and to other allergic reactions later in life.

LEGAL STATUS

The California Department of Fish and Wildlife's Fish and Game Code does not regulate control of the house mouse. A trapping license is not required for house mouse removal. They can be controlled at any time and in any legal manner.

In the state of California, it is illegal to relocate live wildlife, including house mice, away from the property where they were captured without a special permit from the California Department of Fish and Wildlife (CDFW).

MANAGEMENT

A variety of tools and techniques are available for house mouse management, although characteristics at each site will determine the best approach to eliminate these pests. When dealing with an infestation, some form of population reduction is almost always necessary, including the use of traps and chemical control (rodenticides). There is no simple and easy fix for controlling house mice. These tools must be combined with preventive measures like sanitation to remove sources of food, water, and shelter, and exclusion to prevent entry into and movement within a structure.

Sanitation

House mice can survive in very small areas with limited amounts of food, so controlling them can be challenging, especially in and around older structures. While good sanitation (achieved through cleaning and decluttering) will seldom completely control house mice, poor sanitation can attract them and will permit them to thrive in greater numbers. Pay particular attention to eliminating places where house mice can find shelter. If they have few places to hide, rest, build nests, or rear their young, they can't survive in large numbers.

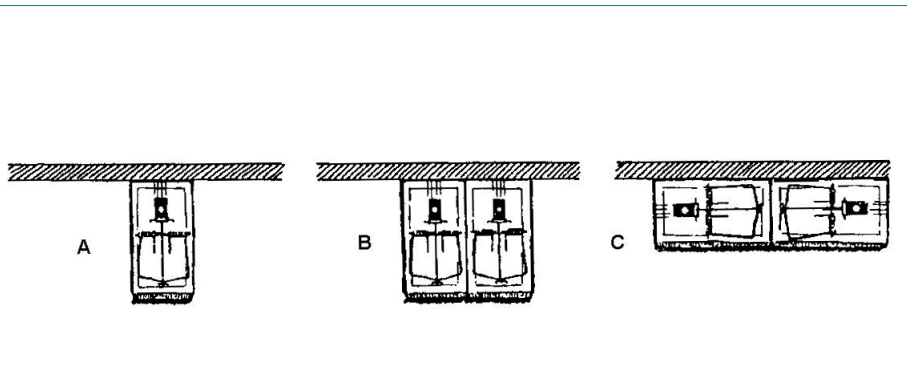


Figure 3. Placement of snap traps: (a) single trap with trigger next to wall; (b) double set, which increases your success; (c) double set placed parallel to the wall with triggers to the outside.

Exclusion

Exclusion is the most successful and permanent form of house mouse control. Keep mice out of buildings by eliminating all gaps and openings larger than $\frac{1}{4}$ inch. Steel wool scouring pads make good temporary plugs but may rust over time. Seal cracks in building foundations and around openings for water pipes, vents, and utility cables with metal or concrete. Doors, windows, and screens should fit tightly. It may be necessary to cover the edges of doors and windows with metal to prevent gnawing. Plastic screening, rubber, vinyl, insulating (expanding) foam, wood, and other gnawable materials are ineffective for plugging holes used by house mice.

Trapping

For most situations, trapping works well and is a great first step in controlling house mice, especially when enough devices are placed in strategic locations near rodent activity. Although time consuming, it's the preferred method in homes, garages, and other structures where only a few house mice are present. Trapping has several advantages: it doesn't rely on potentially hazardous rodenticides, it permits the user to view their success, and it allows for disposing of trapped house mice, thereby avoiding dead house mouse odors that may result when poisoning is done within

buildings. Trapping also can be used as a follow-up measure after a rodenticide program to verify success. In outdoor settings, house mice killed by trapping can be consumed by scavengers without risks of pesticide exposures.

Set traps behind objects, in dark corners, and in places where there is evidence of house mouse activity. Place them close to walls so house mice will pass directly over the trigger (Figure 3). Traps can be set on ledges, on top of pallets of stored materials, or in any other locations where house mice are active and the risk of children, pets, or other nontarget organisms encountering the trap is low. Use enough traps to make the trapping period short and decisive. House mice seldom venture more than 30 feet from their nest sites and food supply, so space traps no more than about 10 feet apart in areas where house mice are active. Pairs of traps set 1 to 2 inches apart can increase capture success for house mice that jump over obstacles.

Snap Traps. Snap traps can be purchased in most hardware and grocery stores. The simple, wooden mouse-size snap trap is the least expensive option, but some people prefer the newer plastic mouse traps because they are easier to set and clean. Traps can be baited with a variety of foods, but the best bait is often the food that house mice are already eating. Peanut

butter is a popular bait choice because it is easy to use and very attractive to house mice but can pose allergy risks to people in some situations.

Mouse traps with a wide trigger plate (Figure 4) have higher catch rates, and triggers should be set lightly so the traps spring easily. Reproductive females are highly motivated to nest-build, so using materials like a ball of cotton wool or dental floss can be an effective bait for traps. Whether you use a food bait or nesting material, be sure to use a small amount on the trigger plate. If you use too much, the house mouse may be able to remove it without triggering the trap.

Live Traps. Multiple-capture live traps for house mice, such as the Victor Tin Cat (Figure 5) and the Ketch-All, are also available from hardware stores and pest control suppliers. They can catch several house mice at a time without being reset, reducing the labor involved. When using such traps, live house mice need to be removed from the trap frequently and humanely euthanized. As stated previously, it is illegal to relocate, or move house mice off the property where they were captured. Relocation is also ineffective; it has been shown that house



Figure 4. Snap trap with an extended trigger plate.

mice removed from their home ranges by as much as a half mile can navigate back to their nest-site. Furthermore, in new environments, released house mice are likely to experience aggressive behavior from other mice, be attacked and killed by a predator, or die from exposure if they cannot find appropriate shelter.

Multiple-kill traps are an option in some settings. One device uses compressed air to move a piston that humanely kills multiple house mice.

Electrocution traps. Battery-operated traps that kill rodents by electrocution (e.g., Owltra and Victor) are considerably more expensive than other traps, but some homeowners, managers of commercial buildings, and pest control companies have found them to provide good house mouse control. As with snap traps, for existing house mouse populations it is important to use enough traps to achieve control in a timely manner. These traps need to be checked frequently, and dead house mice must be removed for disposal.

Glue Boards. An alternative to traps are glue boards, which catch and hold house mice that attempt to cross them, similar to the way that flypaper catches flies. They are available where other rodent control products are sold. One drawback to glue boards is that adult rodents can often detect and avoid the glue before getting stuck, resulting in capture of mostly juvenile individuals. In addition, rodents caught on glue boards and other live-catch traps might not die quickly and will need to be euthanized. Drowning trapped mice isn't considered humane, although trap manufacturers sometimes suggest it. Few options are available that meet ethical guidelines for euthanasia of trapped animals. See the American Veterinary Medical Association guidelines: www.avma.org/resources-tools/avma-policies/avma-guidelines-euthanasia-animals.

If using glue boards, place them along walls where house mice travel. Don't use them where children, pets, or desirable wildlife can contact them. Nontarget animals that become caught on the glue board can be removed in most cases by using vegetable oil as a solvent to loosen the glue. Glue boards lose their effectiveness in dusty areas unless covered. Extreme temperatures also may affect the tackiness of glue boards.

Rodent Repellent Devices

Although house 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 don't penetrate behind objects. They also lose their intensity quickly with distance. There is little evidence that sound, or magnetic or vibrational devices of any kind will drive established house mice or rats from buildings or provide any prevention or control.

Predators

Some dogs and cats will catch and kill house mice and rats. There are few situations, however, in which they will sufficiently control rodent populations. In fact, the presence of



Figure 5. Multiple-capture live trap for mice.

predators can make rodents more cryptic, giving the false impression that the predators have reduced the population. Instead, around most structures, house mice can find many places to hide and rear their young out of the reach of such predators.

Chemical Control

When considering a rodenticide program, decide if the presence of dead house mice will cause an odor or sanitation problem. As mentioned above, house mice tend to stay within 30 feet of their nest, so the use of rodenticide will often result in house mice dying inside the structure where

Table 1. Rodenticides for House Mouse Control Registered for Use in California.

Common name	Example products (trade names)
bromethalin	Assault, Gunslinger, Contrac California
cholecalciferol	CAD3ET All-Weather BLOX, Selontra
zinc phosphide	ZP Ag Pellets or ZP Rodent Oat Bait Ag*

*These zinc phosphide products are restricted use materials.

management is taking place. If this is a problem, trapping may be the best approach.

There are currently a limited number of chemical control options available for house mouse management in California due to recent legislation (Table 1). Rodenticides sold for residential use are only available in ready-to-use bait stations. The rodenticide active ingredients available include two acute toxins: cholecalciferol and bromethalin. Acute rodenticides can be toxic after a single feeding if a lethal dose is consumed. There is evidence that bromethalin can pass through the food chain to predators when they consume house mice that previously ingested this rodenticide.

Because all rodenticides are toxic to people, pets, and wildlife, take special precautions to prevent access to baits by children and nontarget animals. It is very important to always follow the instructions on the product label.

Fertility control products are available that are exempt from EPA registration [FIFRA Section 25(b) minimum risk pesticide]. Evolve claims to reduce fertility in mice.



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WARNING ON THE USE OF PESTICIDES

Pesticides are poisonous. Some pesticides are more toxic than others and present higher risks to people, nontarget organisms, and the environment. A pesticide is any material (natural, organic, or synthetic) used to control, prevent, kill, suppress, or repel pests. "Pesticide" is a broad term that includes insecticides, herbicides (weed or plant killers), fungicides, rodenticides, miticides (mite control), molluscicides (for snails and slugs), and other materials like growth regulators or antimicrobial products such as bleach and sanitary wipes that kill bacteria.

Always read and carefully follow all precautions and directions provided on the container label. The label is the law and failure to follow label instructions is an illegal use of the pesticide. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, and animals. Never place pesticides in food or drink containers. Consult the pesticide label to determine active ingredients, correct locations for use, signal words, and personal protective equipment you should wear to protect yourself from exposure when applying the material.

Pesticides applied in your garden and landscape can move through water or with soil away from where they were applied, resulting in contamination of creeks, lakes, rivers, and the ocean. Confine pesticides to the property being treated and never allow them to get into drains or creeks. Avoid getting pesticide onto neighboring properties (called drift), especially onto gardens containing fruits or vegetables ready to be picked.

Do not place containers with pesticide in the trash or pour pesticides down the sink, toilet, or outside drains. Either use all the pesticide according to the label until the container is empty or take unwanted pesticides to your local Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Hazardous Waste Collection site nearest you. Follow label directions for disposal of empty containers. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

Produced by the **Statewide Integrated Pest Management Program**, University of California, 2801 Second Street, Davis, CA 95618-7774.

Technical Editor: K Windbiel-Rojas

ANR Associate Editor: AM Sutherland

Editor and Designer: B Messenger-Sikes

ILLUSTRATIONS: Figures 1, 2 & 5: Jack Kelly Clark; Figure 3: WE Howard, RE Marsh; Figure 4: N Quinn.

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University of California scientists and other qualified professionals have anonymously peer reviewed this publication for technical accuracy. The ANR Associate Editor for Urban Pest Management managed this process.

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This material is partially based upon work supported by the Extension Service, U.S. Department of Agriculture, under special project Section 3(d), Integrated Pest Management.

Suggested citation: Quinn N, Frye, M. 2025. UC IPM *Pest Notes: House Mouse*. UC ANR Publication 7483. Oakland, CA.

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