

BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

Deer Mice

Family: Cricetidae

Fig. 1. Deer mouse (*Peromyscus maniculatus*)

Fig. 2. Deer mouse

AUTHOR'S NOTE: The term "deer mice" is applied to the entire *Peromyscus* genus and to *P. maniculatus* in particular. "White-footed mice" is sometimes used in reference to the genus and it is also the common name of *P. leucopus*. In the discussion below *Peromyscus* refers to the genus unless followed by a specific name, and "deer mice" refers to *P. maniculatus*.



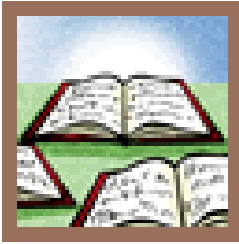
Introduction: *Peromyscus* spp. (Figs. 1 and 2) are one of a very large group of species and subspecies that are widely distributed throughout the United States. They are often referred to as white-footed mice. Notably 7 species are found in California, and of these, the deer mouse is the most broadly distributed throughout the state. The other species are the brush mouse (*P. boylii*), California mouse (*P. californicus*), canyon mouse (*P. crinitus*), cactus mouse (*P. eremicus*), northern Baja deer mouse (*P. fraterculus*), and pinyon mouse (*P. truei*).

Found mostly in rural areas, *Peromyscus* spp. are seldom a significant problem in homes and gardens, except in forested and wooded areas where they are more of a public health threat than an economic threat. The biggest threat associated with deer mice is their ability to spread disease. Deer mice are a particular concern because they are a reservoir (i.e., carrier) of hantavirus, which can be transmitted to humans. The disease, hanta virus pulmonary syndrome (HPS), is potentially fatal, so deer mouse control is important in some areas.



Identification: Coloration varies slightly within species, but almost all have white undersides and legs and feet with brownish upper areas. For deer mice, the tail is usually shorter than the head and body combined, while for other *Peromyscus* spp., their tails are typically as long as or longer than the length of the body and head. Their tails are bicolored with white on the bottom and dark on the top (although the tail is not as strongly bicolored for the cactus mouse). Deer mice have large eyes and ears. These easily identifiable features help to avoid confusion with the common house mouse (*Mus musculus*, Fig. 3). Additionally, there is no characteristic 'mousy odor' which is a musky odor normally associated with house mice. Droppings, nests, and other signs left by these mice are similar to house mice.

Fig. 3. House mouse (*Mus musculus*)



Legal Status: Deer mice are classified as nongame mammals by the California Fish and Game Code. Nongame mammals which are found to be injuring growing crops or other property may be taken at any time or in any manner by the owner or tenant of the premises. They may also be taken by officers or employees of the California Department of Food and Agriculture or by federal or county officials or employees when acting in their official capacities pursuant to the provisions of the Food and Agricultural Code pertaining to pests.



Damage: Because of their small size, deer mice can gain entry into many buildings and often enter vacated homes, cabins, and other structures where they build nests and store food. However, unlike house mice, deer mice are not common in urban and residential areas unless large or numerous parks and/or fields are nearby. Deer mice damage upholstered furniture, mattresses, clothing, paper, drywall and associated insulation materials, or other materials they find suitable for constructing their nests. Nests, droppings, and other signs left by deer mice are similar to those of house mice. However, deer mice have a much greater tendency to cache food supplies such as acorns, seeds, or nuts than do house mice. This may help in the identification of the species of mouse responsible for the observed damage.

Deer mice are also a pest in some forested and agricultural lands. Seed predation by deer mice and other rodents has contributed to slow regeneration or complete reestablishment failure in coniferous forests, especially during the initial stages of regeneration. It is believed that deer mice are the most important predator of seeds in parts of the United States, particularly in Douglas fir stands, where the deer mouse destroys more Douglas fir seed than any other mammal or bird. Douglas fir and other commercial coniferous species are often hand planted despite the added cost, as reforestation by direct seeding of clear-cut areas is particularly prone to predation by deer mice and other seed-eating rodents.

Deer mice are known to feed on seeds in row crops, dig up planted melon seeds, and eat alfalfa seed. Large populations of deer mice also cause damage to almonds, avocados, citrus, pomegranates, and sugar beets. One study estimated deer mouse damage of \$21/acre to almond orchards when they were present.

Although damage from deer mice can be substantial in some situations, the biggest concern usually pertains to human disease transmission. Hantaviruses are a group of viruses found worldwide that (primarily) rodents in the family Muridae carry. Deer mice are the principal reservoir (i.e., carrier) in the western U.S. of one of these hantaviruses called *Sin Nombre* virus. This virus causes hantavirus pulmonary syndrome (HPS) in people. Although human cases are rare, HPS can cause severe respiratory disease in humans, with a fatality rate of about 30%. Infected deer mice shed the virus in their saliva, urine, and droppings. A person may be exposed to hantavirus by breathing contaminated dust after disturbing or cleaning infectious rodent droppings or nests, or by living or working in rodent-infested settings. There are other hantaviruses with other rodent reservoirs elsewhere in the U.S. Infection with these hantaviruses may also cause HPS in people, but there is no evidence that North American hantaviruses are spread from one person to another.

The most effective way to avoid contracting hantavirus is to keep deer mice out of houses, cabins, and other structures by rodent proofing and exclusion (see Exclusion section for further detail). Once deer mice occupy a structure, it is important to control the infestation to decrease the risk of hantavirus transmission to humans. In mouse-infested structures, it is important to avoid activities that disturb mouse-contaminated materials or surfaces. For example, dry sweeping, vacuuming, or simply moving contaminated materials may aerosolize (i.e., stir up) infectious hantavirus particles that can be inhaled.

Before occupying an infested house, cabin, or associated outbuilding, open the doors and windows to air out the rooms for at least 30 minutes. Where possible, use an electric fan on windowsills and in door entrances to assist in the process. Be sure to vacate the building during the ventilation process to

prevent inhaling aerosolized particles. Wearing a commercially available cloth or paper breathing mask may offer some protection, but if they are not fitted properly, such masks may provide little protection or merely provide a false sense of security. Only an approved respirator (properly fitted) equipped with high-efficiency particulate air (HEPA) filters offers full respiratory protection against airborne viruses. As such, the California Department of Public Health (CDPH) does not recommend the use of filter masks as a preventative measure against HPS.

It is important to properly disinfect potentially contaminated areas. Thoroughly wet contaminated areas, including trapped deer mice, droppings, and nests, with an appropriate disinfectant solution such as Lysol or a 10% sodium hypochlorite (bleach) solution. Be sure to follow label directions for proper dilution and contact time for both the bleach and disinfectant solutions. Note that a bleach solution may damage rugs and fabrics and irritate skin. Bleach solutions lose effectiveness over time, so a fresh solution should be made just prior to use (i.e., same day). Wear nonfabric gloves (e.g., rubber, latex, vinyl, or nitrile) whenever touching or cleaning contaminated surfaces or when handling mouse nests, dead mice, or mouse traps.

Once contaminated surfaces have been soaked for 10 minutes when using a 10% bleach solution (or for the contact time provided on the label when using a commercial disinfectant), remove all nest material, dead mice, and/or droppings with a damp towel and then mop or sponge the area with the disinfectant solution. Upholstered furniture and carpets can be shampooed and steam cleaned. If you wish to reuse the gloves used while cleaning contaminated areas, you must properly disinfect them before removal. After removing the gloves, it is important to thoroughly wash hands with soap and water or use a waterless alcohol-based hand sanitizer when soap is unavailable and hands are not visibly soiled.

For more up-to-date information on rodent cleanup, visit the [Centers for Disease Control and Prevention](#) website. For more information on HPS in California, visit the [California Department of Public Health](#) website.



Range: *P. maniculatus* is found throughout California. The other 6 *Peromyscus* species found in California occupy smaller ranges with substantial overlap. *P. maniculatus* is widespread throughout North America where more than 60 geographical races of varying degrees have been identified.

[North American Deer Mouse](#)

[Brush Mouse](#)

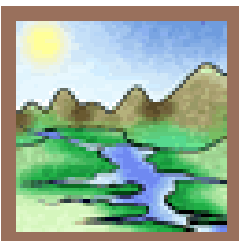
[Cactus Mouse](#)

[California Mouse](#)

[Canyon Mouse](#)

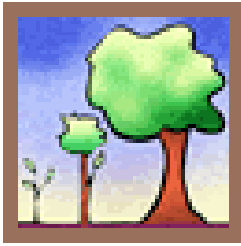
[Northern Baja Deer Mouse](#)

[Pinyon Mouse](#)



Habitat: *P. maniculatus* can be found in nearly every dry-land habitat from above timberline to desert areas. *P. boylii* also exhibits fairly broad habitat usage with a particular preference for foothill hardwoods and hardwood-conifer mixes, chaparral, and mesic habitats. They particularly prefer mesic habitats with substantial ground cover. *P. eremicus* and *P. fraterculus* prefer desert habitats including desert scrub, desert riparian, pinyon-juniper, and sagebrush habitats.

Areas with sandy soils seem to be preferred, presumably due to easier digging for burrow construction. *P. californicus* are generally found in wooded areas. They particularly prefer oak-bay woodlands or mature chaparral or coastal scrub interspersed with grassy areas. Almost any desert habitat within their range is suitable for *P. crinitus*. Of particular interest are steep, rocky areas with sparse plant cover. As their common name would imply, *P. truei* prefer pinyon-juniper and ponderosa pine habitats, especially rocky areas with abundant brush cover, although west of the Sierra Nevada mountain range, *P. truei* can be found in a variety of habitats including coastal redwoods, Douglas fir, and mixed hardwood-conifer habitats.



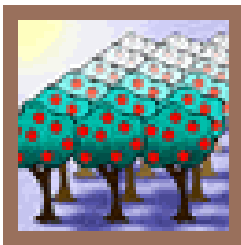
Biology: *Peromyscus* spp. are among the most abundant small mammals in many habitats, a fact which stems from their adaptability and mobility as well as high fertility. Typical home range for a deer mouse is 1/3 to 4 acres. Males will display agonistic territorial behavior in search of reproductive females, and females will defend nest sites during the breeding season (which may extend from late winter through fall). Population densities are generally highest in summer, with 15 individuals per acre on the high side of potential deer mouse

density; deer mouse densities can be even greater in urban and residential settings. It should be noted that even though deer mouse home-range size is not all that large, they can reinvade large areas within a few weeks following removal efforts.

Deer mice eat a wide variety of foods including seeds, nuts, acorns, fungi, and insects, but they do not frequently consume grass, bark, or leaves as do meadow voles. Deer mice are particularly effective seed hunters, and will collect and hoard large numbers of seeds in the fall for winter use. Deer mice are primarily nocturnal and do not hibernate.



In natural habitats, deer mice nest in rotting logs, stumps, buildings, burrows, the ground, trees, in woodrat nests, and among rocks. The nest is lined with fine grass or other soft material. Female deer mice reach sexual maturity at 7 to 8 weeks. The gestation period is 22 to 37 days and there are 1 to 8 young, usually 3 to 5, and 2 to 4 litters are raised each year. The breeding season normally runs from February through November. Deer mice are a principal prey species for a variety of mammals, birds, and reptiles in North America. Deer mice rarely live more than 2 years in the wild.



Damage Prevention and Control Methods

Deer mice are seldom a significant pest in homes and gardens, except in forest and wooded areas where the health concern is more of a threat than economic or damage issues. When their population is high, they can cause significant losses to nut crops such as almonds. Control of deer mice in structures is similar to that for [house mice](#). Exclusion and habitat modification are emphasized, with trapping and toxic baits recommended for reduction and control.

Exclusion: Rodent proof construction or subsequent modification can result in long-term exclusion. For exclusion, initial examination of the structure is required to determine if any gaps or openings are apparent. No openings larger than 1/4 inch diameter should be left unsealed. Deer mice will gnaw to enlarge openings to gain entry. Be sure to check foundations, water pipes, power/cable line entry points, sewer pipes, air vents, and door seals. One of the most common entry points for deer mice are door thresholds with gaps larger than 1/4 inch. Because deer mice are excellent climbers, openings above ground should also be sealed. Steel wool or copper mesh makes a good temporary plug for holes, but they should be checked regularly as they often can be dislodged. Plastic screening, rubber, vinyl, insulating foam, wood, and other gnawable materials are unsuitable for plugging holes or gaps.

Seal cracks in building foundations and gaps around openings for water pipes, vents, and utility cables with metal flashing or concrete. Doors and door screens, pet doors, windows, ventilation screens, and entrances to garages, attics, crawl spaces, and basements should fit tightly. It may be necessary to cover the edges of doors and windows with metal flashing to prevent gnawing. If doors, windows, vents, and screens are damaged beyond repair, replace them immediately. Fit chimneys with a spark arrester to help prevent entry. Use caution when screening dryer vents, as a buildup of dryer lint can cause fires. Remember to keep side doors to the garage closed when not in use, especially at night when deer mice and other rodents are most active.

Ultimately, making a structure impenetrable is a process involving constant revisiting, and may prove impossible in more remote and/or older residences, such as mountain cabins and vacation homes. Special attention should be made to areas in and around hot water heaters and laundry rooms in older cabins and homes in forested areas, as deer mouse activity is often high in these areas. When leaving residences for an extended period of time (1 month or more), all foodstuffs, including pet foods, should be removed or stored in rodent proof containers.

Exclusion using wire mesh fencing is impractical since they are good climbers, although aluminum flashing may be somewhat effective as a fencing material. Deer mice who seek seedlings in a small area can be excluded using a 1/4 inch wire mesh basket over the seedling until the seedlings are a few inches tall. Plastic mesh strawberry baskets serve a similar purpose. If deer mice are feeding on tree crops, aluminum flashing bands wrapped around the tree at heights several feet from the ground can keep mice from climbing up the trunk into the canopy. Be aware that this approach will not likely work if tree canopies overlap or touch.



Habitat Modification: Steps to alter habitats around homes and structures can provide some relief from deer mice. For example, creating more open space and limiting their nesting opportunities increases their susceptibility to predation. An area can be made inhospitable by eliminating weeds, clearing, and mowing. When possible, overgrowth of plants (including overhanging trees) close to buildings should be cleared or cut back (2 feet is probably sufficient). Dumpsters and trash cans should be moved away from structures. Wood piles, fallen trees, brush piles, etc. should be kept at least 20 feet from buildings to eliminate harborage for deer mice. Avoid the storage of materials under structures with raised foundations. Additionally, areas cleared of brush and debris aid in the identification of entry holes or damage from deer mice. However, be aware that habit modification is not always effective given that deer mice can range over 4 acres.

Frightening: Some commercial devices exist today which claim to exclude mice and other rodents from a small area. No scientific evidence is available to demonstrate their effectiveness.

Fumigants: This is not a recommended or practical approach given the shallow depth of deer mouse burrow systems, combined with the potentially large number and inconspicuous nature of deer mouse burrow openings.

Repellents: No repellents have proven effective.

Toxic Bait: Rodenticides can be divided into 3 different groups, according to the active ingredient:

- First-generation anticoagulants: warfarin, chlorophacinone, and diphacinone
- Second-generation anticoagulants (none of which are registered for use against deer mice): brodifacoum, bromadiolone, difenacoum, and difethialone
- Nonanticoagulants: bromethalin, cholecalciferol, and zinc phosphide (the latter being the only one registered for use against deer mice)

Anticoagulants, when used as active ingredients in rodenticides, prevent blood from clotting and cause death as a result of internal bleeding. First-generation anticoagulants usually require multiple feedings over several days to acquire a lethal dose, so they are less likely to injure pets and nontarget wildlife than most other rodenticides.

Second-generation anticoagulants have the same mode of action as first-generation anticoagulants but are substantially more toxic. In some species, they are fatal after only a single feeding. Even after death, anticoagulants can be stored in the tissues of the target animal. Because second-generation anticoagulants are highly toxic and remain active much longer in animal tissues, they aren't registered for use against deer mice.

Zinc phosphide is the only nonanticoagulant rodenticide registered for use against deer mice. Zinc phosphide produces phosphine gas in the stomach of the mouse after ingestion. Because phosphine gas is highly lethal to all animals, it kills after a single feeding.

Rodenticides can poison nontarget animals (e.g., pets, domestic animals, and wildlife) either by direct consumption of toxic baits (primary exposure) or consumption of dead or dying rodents that have ingested toxic baits (secondary exposure). When using any rodenticide, follow label directions and take care to prevent accidental poisonings. Such risks can be reduced by exposing baits only within tamper-resistant bait stations and by locating and properly disposing of carcasses of poisoned rodents.

Controlling deer mice in residential settings: Although rodenticides are available for retail purchase to control house mice and rats, there are no toxic baits registered for controlling deer mice in residential settings. It is a violation of the product label to use rodent baits labeled for use “*only* against house mice, Norway rats, and roof rats” in an attempt to control deer mice.

Controlling deer mice in agricultural settings:

Rodenticides containing first-generation anticoagulants are restricted-use materials in agricultural fields and many noncrop settings, so only certified applicators can apply these materials. Broadcast applications of some first-generation anticoagulant baits (e.g., CDFA’s [Rodent Bait Diphacinone Treated Grain \[0.01%\]](#), and [Rodent Bait Chlorophacinone Treated Grain \[0.01%\]](#)) are allowable for deer mouse control in specific agricultural and noncrop settings (e.g., dormant season applications in orchards and vineyards, roadsides, and ditch banks), although the label must be consulted to verify the legality and timing of their use for each situation. The use of CDFA’s [Rodent Bait Diphacinone Treated Grain \(0.005%\)](#) in an elevated bait station is also highly effective at controlling deer mice in orchard crops. A University of California Division of Agriculture and Natural Resources [publication](#) clearly outlines this application procedure.



Some rodenticide products containing first-generation anticoagulants can be used in and around agricultural buildings such as livestock rearing facilities and dairies, when specified on the product’s label. Therefore, labels must be carefully consulted to verify the legality of using any product for deer mouse control. Applying first-generation anticoagulants inside such buildings may require a bait station if exposure to children, pets, or other nontarget animals is possible. Additionally, bait stations are required for all outdoor applications of rodenticide baits within 50 to 100 feet (exact distance depends on the product label) of any agricultural building. All residential use of agricultural baits is prohibited.

Some rodenticides containing zinc phosphide are currently registered for use against deer mice in agricultural fields in California, although applications are primarily limited to orchards, groves, and vineyards. Because zinc phosphide baits are not always well accepted by rodents, and because hazards to nontarget species can sometimes occur, zinc phosphide baits should be used only by experienced applicators and in strict accordance with label directions. However, because zinc phosphide has very little secondary toxicity risk, it may be the preferred toxicant where secondary toxicity concerns are paramount.

Trapping: Deer mice can be trapped with ordinary mouse snap traps. Peanut butter, peanut butter mixed with sunflower seeds, or dry oats are all effective baits. Multiple traps should be used and will likely be required to effectively manage a deer mouse population. Trap placement is important. To maximize capture success, traps should be spaced no more than 10 feet apart in areas where there is evidence of activity (e.g., chewing, droppings, grease marks). Mice tend to run along walls, so if traps are placed at the juncture of a wall and the floor with the trigger pointed toward the wall, then the

mouse will run directly across the trigger and will likely be caught. Keeping several traps set even after control has been achieved is an effective step to limit resurgence or reinvasion and is also a good monitoring method.

Live trapping of deer mice is not recommended as feces and urine quickly accumulate in the trap, increasing the risk of hantavirus contamination (see Damage section for details on hantavirus). Live trapping is further complicated by the need to humanely euthanize the mouse after capture, as transportation and relocation is not legal without a permit from the California Department of Fish and Wildlife (CDFW).

An alternative trap is the glue trap, identical to those used for house mice. Glue traps should only be used indoors given that extreme dust or temperature can reduce the adherence of the board itself. Their efficacy is based on the same principle as sticky fly paper; the mouse becomes stuck while traveling across the surface of the pad. Glue traps should be set along walls or where droppings are observed. Glue traps are essentially live traps, so captured deer mice will likely remain alive for some time after capture. Therefore, captured mice will need to be humanely euthanized after capture. Deer mice caught in glue traps also pose a greater risk for hantavirus transmission than do snap traps given that feces and urine will accumulate over time. For these reasons, CDPH does not recommend the use of glue traps.

Be sure to wear nonfabric gloves (e.g., rubber, latex, vinyl, or nitrile) whenever setting traps or handling deer mice or their carcasses. Deer mice can be disposed of by double sealing the carcasses in plastic bags before disposal. As a precaution against hantavirus transmission, spray the carcass and trap with an appropriate disinfectant solution such as Lysol or a 10% sodium hypochlorite (bleach) solution. Be sure to follow label directions for proper dilution and contact time for both the bleach and disinfectant solutions (further details provided in Damage section).

Commercial trapping of deer mice requires a trapping license issued by CDFW (see [Chapter 1](#) for additional details).

Predators: Deer mice are prey for a number of predators, including hawks and coyotes, but in urban and suburban situations, the greatest threat is from cats. Although relatively vulnerable to predation, deer mice generally cope well and maintain their populations in spite of this threat.

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