
VOLES (MEADOW MICE)

Integrated Pest Management for Home Gardeners and Landscape Professionals

Six species of voles from the genus *Microtus* occur in California. Collectively they are called either meadow mice or voles. Two species are responsible for the majority of damage. The California vole, *M. californicus*, is the most widespread vole in the state, found in the Owens and Central valleys and nearly the entire length of the coastal range. The montane vole, *M. montanus*, inhabits northeastern California and the eastern Sierra slope. Voles usually don't invade homes and shouldn't be confused with the house mouse, *Mus musculus*.

Voles are intriguing, small mammals, because some populations regularly go through cycles of low to high numbers with occasional, sudden increases that can send numbers soaring up to several thousand per acre.

IDENTIFICATION

Voles are mouselike rodents somewhat similar in appearance to pocket gophers (Fig. 1). They have a compact, heavy body, short legs, a short-furred tail, small eyes, and partially hidden ears. Their long, coarse fur is blackish brown to grayish brown. When fully grown they can measure 5 to 8 inches long, including the tail.

Although voles spend considerable time aboveground and you occasionally can see them scurrying about, they spend most of their time below ground in their burrow system. The clearest signs of their presence are the well-traveled, aboveground runways that connect burrow openings (Fig. 2). A protective layer of grass or other ground cover usually hides the runways. The maze of runways leads to multiple burrow openings that are each about 1 1/2 to 2 inches in diameter.

You can locate the runways by pulling back overhanging ground cover. Fresh clippings of green grass and greenish-colored droppings about 3/16 inch long in the runways and near the burrows are further evidence of voles. With age, the droppings lose the green coloring and turn brown or gray.

BIOLOGY AND BEHAVIOR

Voles are active day and night, year-round. You'll normally find them in areas with dense vegetation. Voles dig many short, shallow burrows and make underground nests of grass, stems, and leaves. In areas with winter snow, voles will burrow in and through the snow to the surface.

Several adults and young can occupy a burrow system. The size of the burrow system and foraging area varies with habitat quality, food supply, and population levels, but in most cases it is no more than a few hundred square feet.

Vole numbers fluctuate from year to year, and under favorable conditions, their populations can increase rapidly. In some areas their numbers are cyclical, reaching peak numbers every 3 to 6 years before dropping back to low levels. Voles can breed any time of year, but the peak breeding period is spring. Voles are extremely prolific, with females maturing in 35 to 40 days and having 5 to 10 litters per year. Litter size ranges from 3 to 6 young. However, voles seldom live longer than 12 months.

Voles are mostly herbivorous, feeding on a variety of grasses, herbaceous plants, bulbs, and tubers. They eat bark and roots of trees, usually in fall or winter. Voles store seeds and other plant matter in underground chambers.



Figure 1. Vole (meadow mouse).



Figure 2. Meadow mouse runways connect numerous, shallow burrows.

Voles are poor climbers and usually don't enter homes or other buildings. Instead, they inhabit wildlands or croplands adjacent to buildings or gardens and landscaped sites with protective ground cover. Most problems around homes and gardens occur during outbreaks of vole populations.

DAMAGE

Voles cause damage by feeding on a wide range of garden plants including artichoke, beet, Brussels sprouts, cabbage, carrot, cauliflower, celery, lettuce, spinach, sweet potato, tomato, and turnip. They also can damage turf and other landscape plantings such as lilies and dichondra. Voles will gnaw the bark of fruit trees including almond, apple, avocado, cherry, citrus, and olive.

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Vole damage to tree trunks normally occurs from a few inches aboveground to a few inches below ground. If the damage is below ground, you will need to remove soil from the base of the tree to see it. Although voles are poor climbers, if they can climb onto low-hanging branches, they can cause damage higher up on trees as well.

Gnaw marks about $\frac{1}{8}$ inch wide and $\frac{3}{8}$ inch long in irregular patches and various angles along with other signs including droppings, runways, and burrows indicate vole damage. If voles gnaw completely around the trunk or roots, it will disrupt the tree's flow of nutrients and water, a process known as girdling. Girdling damage on trunks and roots can kill trees. Signs of partial trunk or root girdling can include a prolonged time before young trees bear fruit, reduced fruit yield, abnormal yellowish leaf color, and overall poor vigor. Where snow cover is present, damage to trees can extend a foot or more up the trunk. Damage that occurs beneath snow cover often escapes notice until it is too late.

LEGAL STATUS

The California Fish and Game Code classifies voles as nongame mammals, meaning if voles are injuring or threatening growing crops or other property, the owner or tenant of the property has permission to control them at any time and in any legal manner.

MANAGEMENT

To prevent vole damage, you need to manage the population in your area before it reaches high numbers. You often can achieve this by removing or reducing the vegetative cover, making the area unsuitable to voles. Removing cover also makes detecting voles and other rodents easier. Once vole numbers begin to increase rapidly, the damage they do to ornamental and garden plants and to trees can be quite severe.

Monitoring Guidelines

Be alert for the presence of voles. Look for fresh trails in the grass, burrows, droppings, and evidence of feeding in

the garden and surrounding area. Pay particular attention to adjacent areas that have heavy vegetation, because such areas are likely sources of invasions.

Habitat Modification

One way to effectively deter vole populations is to make the habitat less suitable to them. Weeds, heavy mulch, and dense vegetative cover encourage voles by providing food and protection from predators and environmental stresses. If you remove this protection, their numbers will decline.

You can reduce the area from which voles can invade gardens or landscaped areas by regularly mowing, spraying with herbicides, grazing, or tilling grassy areas along ditch banks, right-of-ways, or field edges adjacent to gardens. If feasible, weed-free strips can serve as buffers around areas requiring protection. The wider the cleared strip, the less apt voles will be to cross and become established in gardens. A minimum width of 15 feet is recommended, but even that can be ineffective when vole numbers are high. A 4-foot-diameter circle around the base of young trees or vines that is free of vegetation or a buffer strip 4 feet or more along a row of trees can reduce problems, because voles prefer not to feed in the open.

Exclusion

Wire fences at least 12 inches above the ground with a mesh size of $\frac{1}{4}$ inch or smaller will help to exclude voles from the entire garden. These fences either can stand alone or be attached to the bottom of an existing fence (Fig. 3). Bury the bottom edge of the fence 6 to 10 inches to prevent voles from tunneling beneath it. A weed-free barrier on the outside of the fence will increase its effectiveness.

You can protect young trees, vines, and ornamentals from girdling by using cylinders made from hardware cloth, sheet metal, or heavy plastic that surround the trunk (Fig. 4). Support or brace these devices, so they can't be



Figure 3. Small mesh wire fence.



Figure 4. A plastic cylinder protects the trunk of this young tree from vole damage.

pushed over or pressed against the trunk. Also make sure they are wide enough to allow for tree growth and, in areas with snow, are tall enough to extend above snow level. Bury the bottom of the protective device below the soil

surface to prevent voles from digging beneath it. You can cut out both ends of individual milk cartons, tin cans, or plastic soda bottles and fit them over small plants. You'll want to frequently check protective devices to make sure meadow mice haven't gnawed through or dug beneath the cylinders and are hiding inside the tree guard while they feed on the tree.

Trapping

When voles aren't numerous or when the population is concentrated in a small area, trapping can be effective. Use a sufficient number of traps to control the population. For a small garden a dozen traps is probably the minimum number required, but for larger areas, you might need 50 or more. You can use a simple, wooden mouse trap baited with a peanut butter-oatmeal mixture or apple slices, although often you won't need to use bait, because voles will trigger the trap as they pass over it.

Trap placement is crucial. Voles seldom stray from their runways, so set traps along these routes. Look for burrows and runways in grass or mulch in or near the garden. Place the traps at right angles to the runways with the trigger end in the runway. Examine traps daily, removing dead voles or resetting sprung traps as needed. Continue to trap in one location until you stop catching voles then move the trap to a new location 15 to 20 feet away. Destroy old runways or burrows with a shovel or rototiller to deter new voles from immigrating to the site.

Bury dead voles, or place them in plastic bags in the trash. Because voles can carry infectious pathogens or parasites, don't handle them without rubber gloves; you can use a plastic bag slipped over your hand and arm as a glove. Once you have removed the vole from the trap, hold it with your "bagged" hand and turn the bag inside out while slipping it off your arm and hand. Be sure to keep small children and pets out of areas where you have set traps.

Baiting

When voles are numerous or when damage occurs over large areas, toxic baits can be the quickest and most practical means of control. Take necessary measures to ensure the safety of children, pets, and nontarget animals, and follow all product label instructions carefully.

Anticoagulants, often referred to as multiple-feeding baits, interfere with an animal's blood-clotting mechanisms, eventually leading to death. They probably are the safest type of rodent bait for use around homes and gardens, because they are slow acting, must be consumed during a period of 5 or more days to be effective, and have an effective antidote, vitamin K₁, making it safer to use around children and pets. Anticoagulant baits are available at many county agriculture commissioners' offices as well as at retail stores.

You can't use some anticoagulants such as brodifacoum and bromadiolone because of the potential risk they pose to predators such as cats and dogs. These are common over-the-counter rat and mouse poisons. Check the label carefully to ensure it lists that the bait is suitable for use on voles or meadow mice.

Because the pest must feed on anticoagulant baits during a period of 5 days, the bait must be available until the vole population is under control. Usually baiting every other day for a total of 3 applications is effective. As with trapping, bait placement is very important. Place the recommended amount of bait in runways or next to burrows, so voles will find it during their normal travels. Generally, spot treating—placing bait in a specific place, such as a runway—is the preferred method of baiting, but in areas of heavy ground cover or if the area you are treating is quite large, broadcasting might be a better option if the label allows it. When broadcasting bait, be sure to spread it evenly over the infested area. If you use this technique, you probably will have to broadcast every other day for a total of 3 or 4 applications.

Repellents

Commercial repellents are available for protecting plants from voles, but their effectiveness is questionable and their use often isn't practical. You must apply them before damage occurs. Voles usually damage plants at or just beneath the soil surface, making adequate coverage difficult or impossible. Don't apply repellents to food crops unless the product label specifies such use.

Natural Control

Many predators including coyotes, foxes, badgers, weasels, cats, gulls, and especially hawks and owls eat voles. However, in most cases predators can't keep vole populations below damaging levels. Many predators simply don't hunt close to homes and gardens where control is needed. Most predators have a broad-based diet and readily shift to alternative prey when the number of voles declines. Predators rarely, if ever, take every last vole; thus, a residual population remains. With their extremely high reproductive potential, any remaining voles could repopulate an area in a short period. With this potential for severe damage, a homeowner or gardener can't afford to wait for a predator to appear but must take immediate action to prevent the loss of valuable plantings. Effective, immediate action usually involves baiting or trapping and habitat modification.

As with all animals, natural constraints limit vole numbers. Because populations won't increase indefinitely, one alternative is to do nothing, and let nature limit the voles. Experience has shown, however, that around homes and gardens the natural population peak is too high, and damage will be above tolerable limits.

Other Control Methods

Burrow fumigants such as gas cartridges aren't effective for controlling voles, because their burrow system is shallow and has numerous open holes. Commercial pest control operators can use the fumigant aluminum phosphide under very limited conditions. Electromagnetic or ultrasonic devices and flooding also are ineffective against voles.

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Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. 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, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

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

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