

Reducing Vole Damage to Plants in Landscapes, Orchards, and Nurseries

Voles are small mouselike rodents. In Maryland, two species, the meadow vole (*Microtus pennsylvanicus*) and the pine vole (*Microtus pinetorum*), eat roots, bark, and bulbs; even at low population levels, they cause significant damage to orchards, nurseries, and landscapes. This fact sheet explains how to identify these injurious rodents and provides information on vole biology and control.

The Meadow Vole

The meadow vole, also called the meadow mouse or the field mouse, is a small, compact rodent approximately 4 1/2 to 7 inches in length, with small round ears and a tail about twice the length of the hind foot (Figure 1). The back of the mature meadow vole is chestnut brown mixed with black; the belly is dark gray. Young meadow voles are uniformly gray (as are the young of most other small rodents).

Meadow voles live in grassy habitats where they construct a complex network of surface runways (Figure 2). To identify active runways, look for clipped grass and small piles of droppings that resemble green or tan grains of rice. Nests are well-formed balls of interwoven dry grass, usually built at ground level. Where ground cover is sparse or on recently cultivated sites, meadow voles sometimes dig burrows and nest underground.

The Pine Vole

The pine vole, also called the pine mouse, spends nearly all of its life in an extensive system of trails and burrows located 1 inch to 2 feet below ground. The adult pine vole is smaller than the meadow vole, approximately 4 to 5 inches

long, with a shorter tail, smaller eyes, and a more blunt nose (Figure 3). Pine voles have smooth chestnut brown fur on their backs with no black shading.

Moles and Shrews

Moles and shrews may be confused with voles, and they are occasionally caught in traps set for voles. Unlike voles, moles and shrews primarily feed on soil insects and worms and do not damage plants. In fact, they can be beneficial predators because they feed on pest insects, such as Japanese beetle grubs. However, moles often are viewed as pests because their raised tunnels in lawns are considered unsightly. Moles can be identified by their large front feet and claws and by their outward facing palms. Shrews can be distinguished from voles by their pointed snouts and shorter tails (Figure 4).

Vole Biology

Vole populations vary greatly from year to year, depending on climate, food, habitat availability, disease, rodenticide use, and the presence of predators. Like most rodents, voles breed at a very high rate. Meadow voles produce five to 10 litters per year, with an average of five young per litter. Gestation is approximately 23 days, and females can mate again the same day that their young are born. Pine voles produce fewer litters than meadow voles and average only three or four young per litter. However, pine voles probably have a higher survival rate because they live underground, which helps protect them from predators. Young voles grow rapidly, are weaned at only 2 to 3 weeks, and are sexually mature within a month or two. Thus, if the habitat is available, voles can

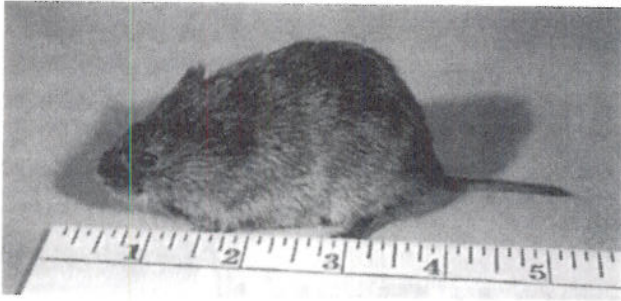


Figure 1. The meadow vole.

increase to damaging levels within a single growing season. The economic threshold for damage by voles is at a very low population level. A single animal living near a tree or shrub may cause sufficient damage to kill the plant or reduce production or landscape values. Population levels are not uniform, even within small areas, making it difficult to predict economic thresholds for damage.

Voles are vegetarians that cause considerable plant damage. During the growing season they eat green, succulent vegetation and fruits. During the fall, winter, and early spring, they feed on roots, stems, and bulbs. Strawberry plants, ornamental trees and shrubs, apple trees, pine seedlings, and herbaceous ornamentals are subject to vole feeding. Ornamental bulbs, such as tulips, also are favorite foods. Voles feed on both roots and stems of herbaceous flowering plants. Boxwoods and other shrubs with dense, low-growing canopies provide good vole habitat and often are damaged by vole feeding (Figure 5). Voles kill trees by girdling them, eating the bark at ground level (Figure 6). Pine seedlings in commercial forests and Christmas tree plantations sometimes are pulled down into vole tunnels and consumed entirely.



Figure 2. Surface runways constructed by voles.

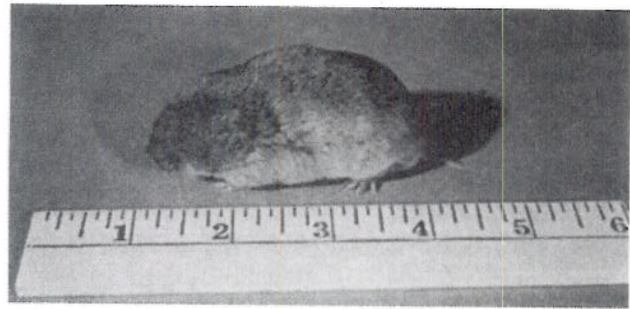


Figure 3. The pine vole.

Control Recommendations

There is no "magic pill" for vole control; no single, simple remedy solves the problem. Following positive identification of the rodent, integrated pest management (IPM)—the appropriate combination of habitat reduction, trapping or poison baiting, and predators—is the best known approach to reducing vole populations (Figure 7). Monitor vole sites in early spring and again each fall to detect rising numbers before plants are damaged.

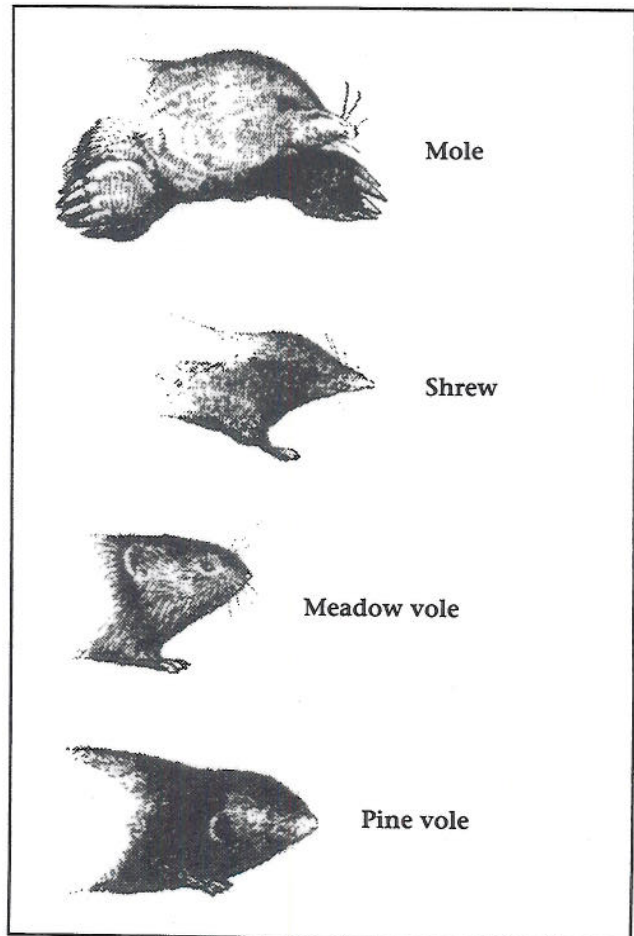


Figure 4. Mole, shrew, and vole heads.



Figure 5. A shrub damaged by vole feeding.

Vole Monitoring

Several monitoring techniques can be used to detect voles before extensive plant damage occurs. To locate meadow voles, look for surface runways in long grass. Fresh grass clippings and piles of droppings, often found near the bases of large clumps of grass, indicate the presence of voles. Another useful indicator is the apple slice index (described in following paragraphs). The two indicators used together can provide a reliable assessment of damage potential.

Pine voles construct underground runways. Look for entrance holes 1 1/2 inches in diameter and small piles of earth near tree trunks and along the edges of mulched beds. Because pine vole tunnels are shallow and narrow, heavily infested areas have the appearance of being cultivated. (In contrast to voles, moles create piles of fresh earth up to 9 inches high and raise large serpentine ridges in turf).

It is important to make a positive identification of a pine or meadow vole through trapping. Relying only on the presence of surface tunnels or underground runways can be confusing; according to some research, meadow voles will tunnel and cause damage like pine voles. In other cases, pine and meadow voles have been found using



Figure 6. Voles kill trees by girdling them—eating the bark at ground level.

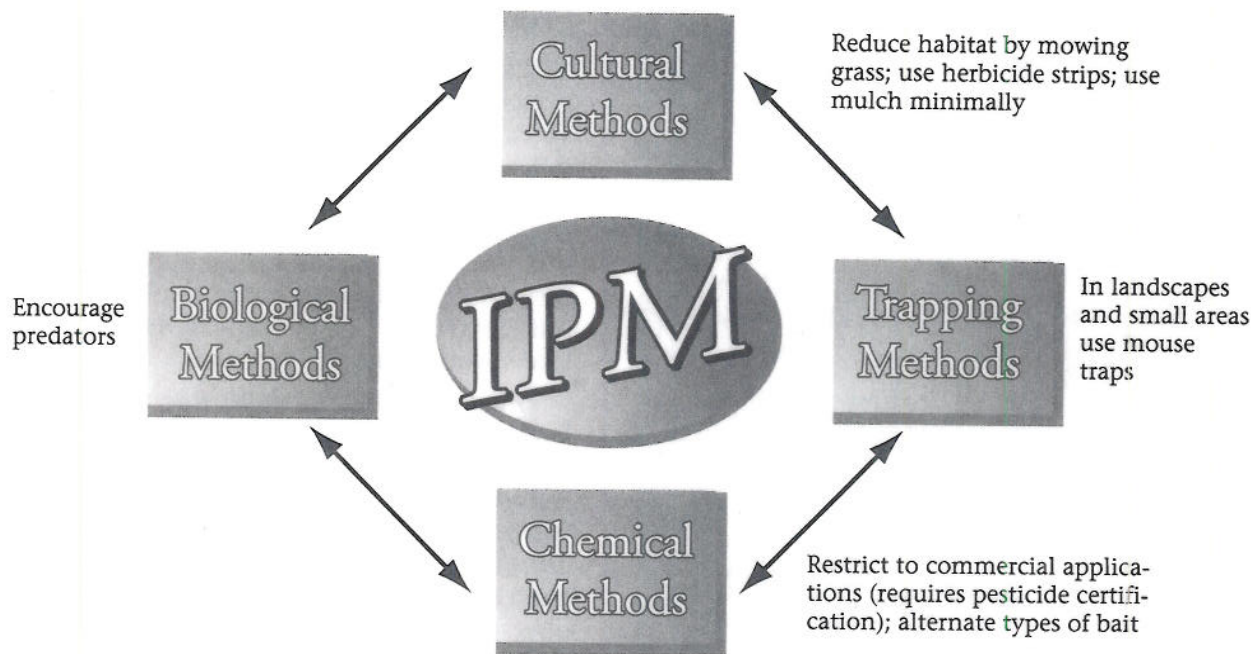


Figure 7. Integrated pest management (IPM) is the best approach to reducing vole populations.

the same tunnels at different times. The conditions necessary for one species to move in where another was found previously are not known. Which species is present can have important implications for which type of control will be effective. Because both species may be found on the property, trapping to positively identify the animals is the only sure way to tell.

To use the apple slice index method, place apple slices in suspected runways, near tunnel entrances, and under a roofing shingle, a piece of tar paper, or similar covering. Place the covered apple slices under the canopy of selected trees, and check daily for tiny, elongated toothmarks. The percentage of apple slices that are partly eaten, missing, or otherwise disturbed indicates the percentage of trees or a landscape infested by voles.

Commercial operators should monitor vole activity regularly to identify increases in vole activity and populations. At the least, monitor voles at the end of the breeding season (early winter) when populations reach their maximum and at the beginning of the breeding season (spring) when populations are at a minimum. Population levels are usually expressed as voles per acre. Survey rows of trees in each production area (one row in the center and another transecting at a 45-degree angle). Determine the percentage of trees with vole activity either by using the apple slice index method, visual inspection of tunnel systems, or both. Regular monitoring will identify increases in vole

activity. If the population warrants control measures, continue to monitor the site regularly, even after the population has been reduced. Voles are notorious for sudden population eruptions. They will also invade quickly from surrounding areas to repopulate an area where vole populations have been controlled.

Habitat Reduction

Voies are a great problem in many landscapes and gardens that have thick layers of mulch in flower beds and around trees. Loose, easily excavated mulch provides ideal habitat for voles. Therefore, keep mulch as shallow as possible—ideally no deeper than 1 inch—even if it means a few more weeds. Avoid the use of landscape fabrics (weed barriers), which provide habitat and predator protection for voles in landscapes.

Landscapes that are designed using wide-spreading woody ground covers, such as junipers, yews, and cotoneasters spaced very closely, give “instant coverage” and create ideal cover from predators and excellent nesting sites for voles. When selecting ornamental shrubs, include upright varieties that allow open space between the plants; when you plant low-growing shrubs, increase the space between them. This will expose the voles to predators, such as hawks, owls, foxes, and cats.

Grassy or weedy areas are excellent vole habitat. Therefore, areas around gardens should be

mowed frequently to reduce the protective cover and expose voles to natural predators.

Herbicides suitable for orchards, nurseries, or plantations can be used to clear vegetation from a 4-foot circle at the base of trees in the fall to help keep voles away from the tree trunks. When clearing tree bases, do not expose previously covered bark; this tissue is highly susceptible to winter injury. Be careful not to leave a depression when removing weeds from under young trees. It may hold water that could freeze and suffocate roots. Where a heavy growth of vegetation is present, herbicide applications should be timed to prevent a thick accumulation of dead material, which could harbor mice. Each fall, rake off leaves and grass from around trees.

If clearing around trees is not possible, frequently mowing grass will be helpful. Even if areas around trees are cleared, frequent mowing of areas between trees will help to further reduce protective cover for voles.

Protect young tree trunks from meadow voles by embedding cylindrical wire guards up to 3 inches into the soil at tree bases (Figure 8). Guards should be taller than average snow depth so that voles cannot crawl over the top and girdle the stems. Guards are less effective against pine voles because they can tunnel under the guard. These guards usually are made from 1/4-inch mesh galvanized hardware cloth. Bend the wire mesh into a cylinder large enough to allow for 5 years' growth. After the guard is in place, use three short pieces of wire to secure an overlap of approximately 1 inch. Installing guards when planting minimizes damage to tree roots. Check guards in the fall to be sure their bases are still buried properly. Other materials, such as rolled roofing, aluminum foil, sheet metal, and specially made plastic spiral wraps, are also used for tree guards. However, none of these are as satisfactory as wire mesh. Wire mesh guards will provide many years of protection, repaying your investment of labor and materials.

Predators

Encouraging vole predators is often underestimated as a control measure. It is true that many predators are not present until voles have already reached damaging levels; however, encouraging predators can form the basis for long-term control. One of the best vole predators is the domestic house cat. A healthy young cat will hunt voles all year long and help reduce the population. Note that the cat does not have to be

starved to hunt, and it will do a better job if it is well fed and secure in its territory.

Hawks, owls, and crows also feed on voles. Owls hunt at night, whereas hawks and crows hunt in the daytime; all consume large numbers of small rodents. In many landscapes, a lack of proper perch sites overlooking vole-infested areas limits the effectiveness of hawks, owls, and crows because they hunt by scanning the ground from a perch, then swooping down to capture prey. Installing a perch can assist in long-term rodent control. A perch can be constructed using a wooden pole properly secured in the ground, with a 2- to 3-foot cross tee at 8 to 10 feet above the ground. One or two per acre spaced to provide maximum viewing of the ground area should suffice.

Black snakes and king snakes also are highly effective predators of small rodents, and they do not harm humans. They should not be killed or disturbed if seen in residential landscapes.

Traps

In yards, gardens, and smaller landscapes, trapping can be as effective as chemical controls. Trapping is, however, labor-intensive and may not be the best option for orchards, nurseries, tree plantations, and other commercial operations.

Use ordinary mousetraps to trap voles. Fall is probably the best time to trap: Voles accept bait more readily after the first hard frost when more desirable foods are less plentiful. Also, it is best to reduce populations before the winter, when damage to woody plants is the greatest.

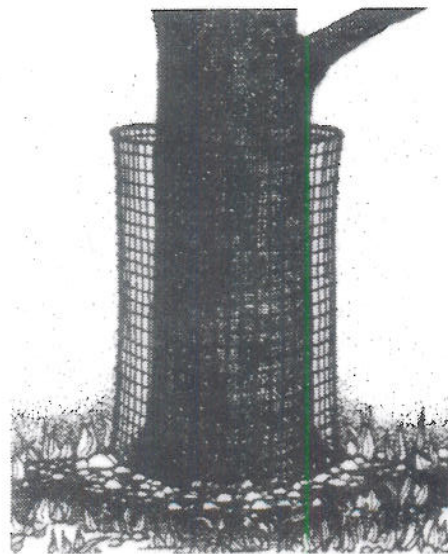


Figure 8. Wire tree guard.

Meadow voles can be trapped by setting traps at right angles to their runways in the grass. No excavation is necessary to set the trap. The tunnels are in the grass thatch or just beneath the surface of the ground. Bait the traps with peanut butter or small slices of apple that include part of the skin. Try to place the apple bait on the trap trigger to prevent voles from stealing the bait without springing the trap.

For pine voles, place baited traps in excavated areas at right angles to the line of the tunnel (Figure 9). Allow the traps to rest flush with the bottom of the tunnel. Traps can be covered with curved cardboard or roofing shingles, but covers are not essential. Use at least one trap per 100 square feet (10- by 10-foot grid) in smaller infested areas or at least 80 traps per acre in runways in larger areas.

Instead of using snap traps, live pitfall traps can be used to control rodent populations. Sink coffee cans or quart glass mason jars in tunnels with the mouth level with the tunnel floor. Voles will drop into the "pit" where they cannot escape. A disadvantage to this type of trap is that the live rodents must then be disposed of.

After traps are set, check them every few hours. Immediately remove the dead voles and reset the traps. Then, check the traps once or twice a day for about 1 week, removing any dead voles and resetting the traps. After a week of intensive trapping, the daily number of voles caught should be near zero. If not, continue to trap until none are caught for several days in a row. After removing the traps, you may prefer to leave covers over the tunnels so they can be monitored regularly. In the fall and early spring, check again for voles by placing apple slices in the tunnels. If toothmarks appear on the apples, repeat the trapping process.

Dead rodents and traps must be handled carefully. Serious respiratory diseases in humans in the Southwest and Florida and other states have been attributed to micro-organisms found in rodent feces and urine. The deer mouse, common in Maryland, is considered a possible host for these diseases, but voles have not been identified as hosts. When handling dead rodents and traps, it is very important to wear disposable gloves, and wash hands well afterward. Treat dead rodents and traps as possible carriers of disease. Bury the dead rodents immediately.

Chemicals

Home and landscape applications. The use of chemical baits in landscape applications poses many risks. Although products are available at

garden centers, their potential harm to nontarget species, such as domestic animals and children, is very high unless they are used with extreme caution. For these reasons, it is not recommended that homeowners use these materials for vole control in their home landscapes. Use of other control methods, such as trapping and cultural modifications, should be sufficient.

Nursery and agricultural applications. Commercial orchardists and other agriculturists suffer substantial economic losses as a result of vole damage. The choice of control method will depend on its reliability and on its cost relative to other effective control measures. "Clean culture" programs that reduce habitat consist of maintaining bare soil strips within rows and close mowing of grass between rows. This approach will not only increase tree growth in orchards but can be very effective in helping to prevent the establishment of voles, with little cost. However, once a vole population is established, poison baits or rodenticide treatments are the quickest and most effective way to control them.

Rodenticides are available from agricultural supply stores. Over-the-counter formulations vary widely in their effectiveness. However, you must have a certified pesticide applicator license in order to obtain and use most effective rodenticides. When using poison baits, always carefully follow the instructions on the label to avoid injury to yourself, other people, or pets and wildlife.

Rodenticides are classified as either acute or chronic in their action. Acute rodenticides (e.g., zinc phosphide) are fast-acting poisons that usually will quickly kill voles after one feeding. In contrast, chronic rodenticides, which include most anticoagulants, require multiple feedings to kill voles. These are available to certified pest control

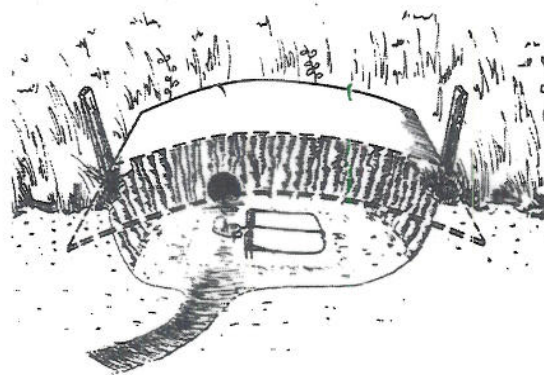


Figure 9. Trap placed at entrance of an excavated vole tunnel; covering is optional.

applicators through pesticide distributors. When you use poison baits, it is suggested that you rotate rodenticides so that the voles do not develop bait shyness, a common problem with zinc phosphide.

Timing can affect the success of a poison-bait program. The optimum times to apply poison baits are after the fall harvest and in the winter and early spring. Early spring applications can reduce populations before most females begin breeding for the year, but vole populations can quickly recover before the next winter. As the spring progresses and natural foods become more abundant, baiting becomes less effective. During the fall, bait acceptance increases again. Late fall applications reduce vole populations just before winter, when these pests do the most damage. Unfortunately, voles may quickly reinvade from surrounding areas and still cause significant winter damage, especially under the cover of snow. Winter is an ideal time to deliver bait, when most damage occurs and bait acceptance is greater as a result of natural food shortages.

Bait placement is critical to the success of a rodenticide program. The contrasting living habits of meadow and pine voles have important implications for their detection and control. Dispersing bait over an entire area, or broadcast baiting, is more effective against meadow voles because they live on the ground and forage more widely than pine voles. However, broadcast baiting may work on pine voles where the ground cover allows surface runways. Broadcast baiting, although less labor intensive than hand baiting, can be as expensive as hand placement because larger quantities of bait are required for treatment. The largest disadvantage of this method is the high possibility of harming nontarget species. For this reason, it is recommended that hand baiting or bait stations be used.

A major problem with all baits is they quickly absorb moisture, and many applications do not last for more than a few weeks. Placing bait for pine voles in tunnels or under roofing shingles, slabs of wood, split automobile tires, or other similar materials will help protect the bait from moisture and nontarget species. Bait stations placed above active runways or tunnels give the best results for pine and meadow voles.

An effective bait station can be constructed from an automobile tire split in half longitudinally. Tire splitters are available commercially, or local tire companies can split tires at a nominal cost. Arrange tire halves hollow-side down, and distribute one per tree or one every 10 yards throughout the infested area. There is no need to

provide entrances. Place bait in small cups under the tires. The rounded shape of the tire prevents moisture from dripping into the bait cup, and heat inside the tire can help to attract the voles.

Another bait station design consists of three pieces of 40-gauge, 1 1/2-inch-diameter PVC tubing joined in the shape of an inverted "T" by a PVC tee joint. The vertical tube is 12 inches long and covered at the top with a PVC cap or 12-ounce soft drink can opened at one end to keep out rain and snow. Each of the bottom, horizontal pieces is 6 inches long with the outside end cut at a 45-degree angle. The pieces are cemented together with PVC cement. Bait is placed in the vertical tube, and voles enter through the side tubes and feed. Each station may be secured to a tree with rope and placed in natural or manufactured tunnels. This bait station has been effective in some Northeastern orchards during winter and early spring. Remember to follow the label when using any rodenticide.

A considerable amount of research on habitat modification and chemical control has been done to combat voles. Further research on vole ecology must be done to better understand the factors that influence vole populations. More specific recommendations of the use of rodenticides can be found in the publications noted in the Acknowledgments and References.

Acknowledgments

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For more information on Wildlife Damage Management, ask your county Extension agent for Fact Sheet 655 "Resistance of Woody Ornamentals to Deer Damage."

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