

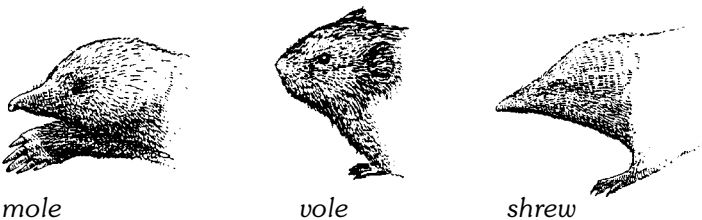
Voles



Voles are small, chunky, ground-dwelling rodents. Mature voles are 5 to 7 inches long and have stocky bodies, short legs, and short tails. Adults are chestnut-brown mixed with black, and their underparts are dark gray. The underfur is generally dense and covered with thicker, longer guard hairs. Their feet are brownish, and the thin hair that covers their tails is dark on the upper surface, gradually changing to a lighter gray beneath. They have small black eyes, and their ears are furred and do not project much above the hair. The young are uniformly gray.

Voles have other common names, including meadow mice, ground moles, field mice, and meadow moles. The use of these terms can cause confusion when identifying rodents. It is important that small mammals be identified correctly before starting control activities, since materials and methods effective against one species may not be useful on another.

Voles are frequently mistaken for moles, shrews, and mice. Moles have greatly enlarged front feet, with prominent digging claws. Moles also have no external ears and very small eyes. Shrews are smaller than voles, and have long, pointed snouts and pointed front teeth, with their eyes and ears nearly hidden in their fur. Voles have rounded, blunt snouts, and their front teeth are chisel-shaped. Their eyes and ears are readily apparent. The distinction between voles and mice is less obvious. The best way to distinguish them is by tail length. Mice have long tails that extend nearly half their body length, whereas voles have short tails.



Four species of voles occur in Pennsylvania: the meadow vole (*Microtus pennsylvanicus*), the woodland (or pine) vole (*Microtus pinetorum*), the red-backed vole (*Clethrionomys gapperi*), and the rock vole (*Microtus chrotorrhinus*). The red-backed vole and rock vole are primarily restricted to mountainous areas, and it is the meadow vole and woodland vole that are most often responsible in damage situations.

General biology

The meadow vole is most often found in extensive grassy or weedy areas such as old fields and moist hillsides with heavy groundcover. However, stream and pond banks, orchards, pastures, hay fields, and fence rows also provide suitable habitat for meadow and woodland voles. Meadow voles occasionally invade lawns, gardens, and nurseries. Woodland voles are most abundant in southeastern Pennsylvania, where they are common in old fields, thickets, gardens, orchards, and the edges of agricultural land, particularly where the soil is loose and sandy.

Voles eat a wide variety of plants, most frequently grasses and forbs. In late summer and fall, they store seeds, tubers, bulbs, and rhizomes. They eat bark at times, primarily in fall and winter, and will also eat grain crops, especially when their populations are high. Occasional food items include snails, insects, and animal remains. Voles are active day and night, year-round, with peak activity occurring at dawn and dusk. They do not hibernate. Their home range is usually $\frac{1}{4}$ acre or less, but this range varies with season, population density, habitat, and food supply.

Voles are semifossorial, and as such, construct many tunnels and surface runways with numerous burrow entrances. A single burrow system may contain several adults and young. Vole nests are globular structures of dry grass about 6 to 8 inches in diameter. Nest cavities are usually located on the surface of the ground or under old boards, discarded metal, logs, or other such cover. In winter, above-ground nests may be made in deep snow, but these are temporary and will be vacated when the snow melts.

Voles may breed throughout the year, but most commonly in spring and summer. Generally, they have 1 to 5 litters per year. Litter sizes range from 1 to 11 young, but usually average 3 to 6 young. The gestation period is about 21 days. Young are weaned by the time they are 21 days old, and females are sexually mature in 35 to 40 days. Voles have short lifespans that generally range from 2 to 16 months.

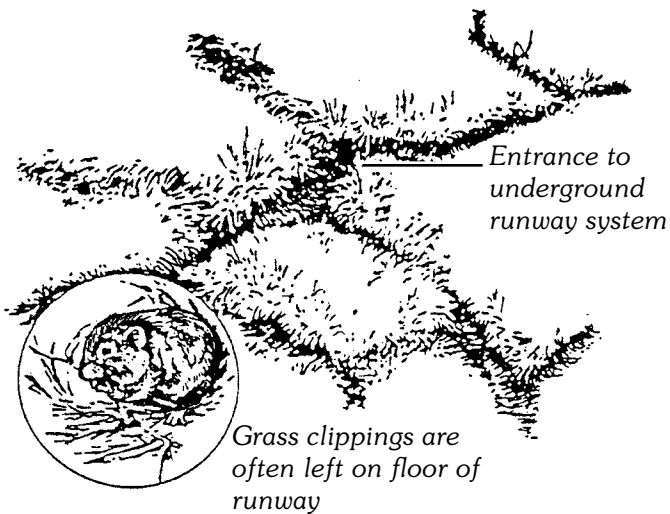
Large population fluctuations are characteristic of voles. Population levels generally peak every 2 to 5 years; however, these cycles are not predictable. Extremely high vole densities sometimes can occur during population irruptions.

Food quality, climate, predation, physiological stress, and genetics have been shown to influence population levels.

Voles are an important part of the food chain, serving as prey for many predators such as hawks, owls, snakes, weasels, raccoons, foxes, opossums, and house cats.

Description of damage

Voles may cause extensive damage to orchards, ornamentals, and tree plantings by gnawing on the bark of seedlings and mature trees (girdling). They eat crops outright and also cause damage by building extensive runway and tunnel systems through crop fields. Underground, woodland voles may consume small roots, girdle large roots, and eat bark from the base of trees. After the snow has melted in early spring, the runway systems of meadow voles can also create unsightly areas in lawns, golf courses, and ground covers. However, this usually is only a temporary problem.



The most easily identifiable sign of meadow voles is an extensive surface runway system with numerous burrow openings (see diagram). Voles keep these runways free of obstructions, and vegetation near well-traveled runways may be clipped close to the ground. Overhanging vegetation provides cover as they travel along runways. Such travel lanes, about 1½ inches wide, are reliable indicators of meadow vole activity. Woodland voles do not use surface runways, but rather build extensive systems of underground tunnels. As they build the tunnels, they push out dirt, producing small, conical piles of soil on the ground surface. These small, conical piles of soil are an indicator of woodland vole activity.

Bits of freshly cut vegetation and accumulations of vole droppings (brown or green in color and shaped like rice grains) in surface runways are positive evidence that the runways are being used. Vegetation, small roots, or mold in the paths indicate that voles no longer use them. Meadow voles may also build and use underground tunnels, and they will often use underground tunnels made by moles or woodland voles.

Homeowners often notice meadow vole damage in spring, when melting snow reveals the criss-cross network of runways voles used to travel under the snow. Under the cover of snow, meadow voles may travel safely into areas they would not normally venture, such as open lawns or grassy areas. Usually the voles leave with the melting snow, and the lawn quickly recovers.

Both meadow and woodland voles can cause extensive damage in orchards and nurseries by gnawing on tree bark. This type of damage is generally most severe in winter when other food sources are limited. However, girdling and gnaw marks alone do not necessarily indicate the presence of voles, since other animals, such as rabbits, may cause similar damage. Vole girdling can be differentiated from girdling by other animals by the nonuniform gnaw marks that will occur at various angles and in irregular patches. Marks are about ⅛ inch wide, ⅜ inch long, and ⅓ inch or more deep. Rabbit gnaw marks are larger and more uniform. Rabbits neatly clip branches with oblique, clean cuts. Examine girdling damage and accompanying signs (feces, tracks, and burrow systems) to identify the animal causing the damage.

Woodland vole damage is more difficult to detect because it occurs underground. Injured trees grow more slowly, look off color, and generally appear sickly. Often by the time orchardists note weak, unhealthy trees, the damage to tree roots is already extensive.

Legal status

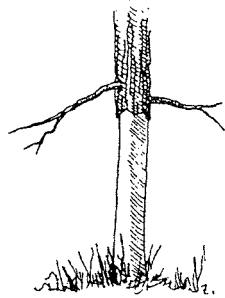
Voles are classified as nongame mammals and are protected. However, they can be controlled when causing damage.

Damage control

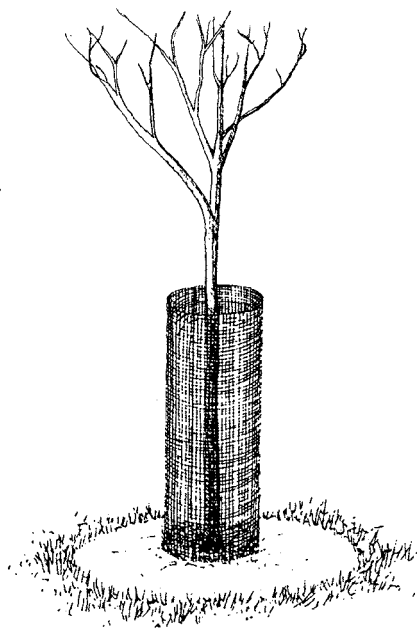
The preferred vole damage control techniques vary with the size of the population. When populations are low, and damage is not extreme, exclusion or trapping may be the most economical means of avoiding damage. Large populations causing extensive damage may warrant the use of repellents and toxicants. If the property owner does not feel he or she can properly handle the necessary damage control techniques, many wildlife pest control operators are available throughout the state that deal with vole problems. Contact your county extension office or the yellow pages for information regarding these operators.

Exclusion

Wire guards made of ¼-inch hardware cloth will help prevent meadow vole damage to small trees and shrubs. Wire cylinders 18 to 24 inches high set into the ground around the trunk will prevent meadow voles from girdling the tree. Tree guards should be large enough to allow for 5 years of growth. Bury the wire 4 to 6 inches deep to keep voles from burrowing under the cylinder. These guards will also protect against rabbit damage. Large-scale fencing of areas is probably not cost-effective. (See the diagram on the following page.)



Vole damage to sapling



Wire cylinders protect saplings from vole damage.

Habitat modification

Habitat modification practices can reduce the likelihood and severity of vole damage. The roots and stems of grasses and other groundcover are the major food sources for voles. As a result, eliminating weeds, ground cover, and litter is an excellent method of achieving long term control of voles. Repeated mowings that maintain groundcover at a height of 3 to 6 inches reduce both food and cover and expose voles to predators. Therefore, lawn and turf should be mowed regularly.

If voles are damaging trees, clear all mulch 2 feet or more from the bases of trees. Establishing vegetation-free zones that extend at least 2 feet from tree trunks under tree canopies will discourage voles from living near the bases of trees, where they cause the most damage. Vegetation-free zones can be created by mowing, applying herbicides, cultivating, or placing a layer of crushed stone or gravel 3 to 4 inches deep around the trunk. Do not allow prunings, leaves, or decaying vegetation to accumulate around the bases of trees.

Frightening

Agents designed to frighten rodents are not effective in reducing vole damage.

Repellents

Repellents containing thiram (a fungicide) or capsaicin (the ingredient that makes chili peppers hot) are registered for vole control. Little data is available on the effectiveness of repellents to deter vole damage. Therefore, repellents should not be used as the sole method of vole control.

Thiram-based repellents are labeled for use on tree seedlings, shrubs, ornamental plantings, nursery stock, and fruit

trees. Most labels only allow thiram to be used on fruit trees during the dormant season. Capsaicin-based products are labeled for use on ornamental trees, fruit and nut trees, fruit bushes and vines, nursery stock, shrubs, and lawns. Capsaicin should be applied only before the fruit sets or after the harvest. Capsaicin is registered for use on vegetable plants and agricultural crops only before edible portions and/or heads begin to form.

To prevent a feeding pattern from developing, repellents should be applied before damage becomes significant or, in the case of monitored populations, before damage occurs. They must be reapplied frequently after a rain, heavy dew, or new plant growth. Always follow label directions for the repellent being used. Never apply repellents to any portion of a plant likely to be eaten by humans or livestock unless the label permits it.

Toxicants

Zinc phosphide and anticoagulant baits are registered for use on voles. These toxicants are restricted-use pesticides. Any person using these pesticides must be a certified pesticide applicator or work directly under the supervision of a certified applicator.

For large acreages such as orchards and Christmas tree plantations, the careful use of toxicants may be warranted, because they provide the quickest and most practical means of bringing large populations of voles under control. The most selective and effective method involves placing the toxicant directly into vole runways or underground burrows.

Zinc phosphide is the toxicant most commonly used to control voles. It is a single-dose toxicant available in pellets, as a concentrate, and as a grain-bait formulation. Zinc phosphide baits generally are placed directly into runways and burrow openings at rates of 2 pounds per acre. Although prebaiting (application of similar nontreated bait prior to applying toxic bait) is usually not needed to obtain good control, it may be required in some situations, such as when a population has been baited several times and bait shyness has developed. Zinc phosphide baits are potentially hazardous to ground-feeding birds, especially waterfowl. Minimize risks to nontarget wildlife by placing bait directly in burrow openings or in runways and tunnels under cover boards.

Anticoagulant baits also are effective for controlling voles. Anticoagulants are slow-acting toxicants in pellet form that take effect in 5 to 15 days. Multiple feedings are needed for most anticoagulants to be effective. Recommended application rates for anticoagulant toxicants are 10 pounds per acre when placing pellets directly into runways. If vole problems persist, reapply the anticoagulants 30 to 60 days later.

Because of the hazard to nontarget wildlife, it is recommended that baits be placed in bait containers. Water repellent paper tubes with the bait glued to the inside surface make effective, disposable bait containers. Tube size should be about 5 inches long and 1½ inches in diameter. Bait containers protect bait from moisture and reduce the

likelihood that nontarget animals and small children will consume the bait. Bait stations also can be made from discarded beverage cans. Enlarge the opening in the end of the can so that it is about 1½ inches in diameter and place a dent in the side of the can. Put the bait in the can and place the can, dented side down, in the area to be protected. Mark the bait containers with flags or stakes so they can be relocated. Another type of bait station that has been successful is made from an automobile tire split longitudinally. Tires are placed with the hollow side down, and the bait is placed in a small cup under the tire. The tire halves are then distributed throughout the area at a rate of one per tree or one every 10 yards. Discontinue use if nontarget animals are coming into contact with bait.

Woodland voles are not as active above ground, so when targeting these types of voles, place the bait directly in runways and burrow openings under infested trees at two to four locations. If runways and burrows cannot be found, roofing shingles, boards, or other objects may be placed on the ground to encourage woodland voles to build tunnels or nests under them. Bait can then be placed under these shelters once woodland voles are using them.

Timing also influences the success of control programs. Wet weather reduces the effectiveness of toxicants. Therefore, try to place the bait when the weather is likely to be fair and dry for at least three days. Baits are most effective when naturally occurring foods are limited. Late fall is an important time to place bait for voles because this practice helps reduce populations before the onset of winter, when vole damage is most severe and snow cover precludes the use of toxicants. When the vole population is high during early spring, baits should be applied before the breeding season and before the renewed growth of groundcover reduces the chance that voles will accept bait.

Toxicants are poisonous to all forms of animal life. Nontarget animals can be injured or killed by eating toxicants directly or by eating voles that are killed by toxicants. Therefore, do not place bait in piles or on bare soil. Do not use baits where there is a chance of harming humans, domestic animals, or desirable wildlife. It is unlawful to use pesticides in a manner inconsistent with their labeling.

Fumigants

Fumigants usually are not effective because the complexity and shallow depth of vole burrow systems allow fumigants to escape.

Trapping

Although not effective on a large scale, trapping is the safest way to remove voles in home grounds or in small orchards before vole numbers are extremely high. Fall and late winter are periods when voles are easiest to trap. Set mouse-sized snap traps at burrow openings or in runways near ornamental shrubbery, flower beds, gardens, or rock walls. Bait the traps with a peanut butter-oatmeal mixture or apple slices. Set the trap perpendicular to the runway, and cover the trap with an inverted cardboard box or pan.

Be sure to allow space for the trap to operate freely under the covering. Check the traps twice daily, in the morning and evening, and reset the traps until no more voles are captured. Although voles rarely invade houses, in the event that they do, they can be controlled by setting snap traps or live traps (Sherman or box-type) as you would for house mice.

Live trapping

Voles may be live trapped using mouse-sized box traps in areas of vole activity. Bait the traps with a peanut butter-oatmeal mixture or apple slices. Voles should be released more than a half mile from the capture site into overgrown fields or other grassy areas where they will not pose a problem for other landowners.

Other methods

A wide variety of predators feed on voles. Voles are relatively easy for most predators to catch and are active, and therefore vulnerable, day and night and year-round. Despite their vulnerability, vole populations usually are not controlled by predators, because voles have a high reproductive potential and can increase their populations at a faster rate than predators. However, predators may help keep populations low once the initial vole populations have been reduced through alternative techniques.

Leaving large trees or installing raptor perches in the area may encourage birds of prey to hunt in areas experiencing vole damage. Raptor perches, which consist of 10- to 15-foot poles with 1- to 2-inch diameter perches on top, provide elevated overlooks for hawks and owls. One perch per 5 acres, located on higher ground, should be sufficient. Nest boxes also can be provided to encourage kestrels (small falcons that feed on rodents) to nest in areas where voles are active. Raptor perches and nest boxes are not recommended in areas where toxicants are heavily used.

Materials and suppliers

Most of these products are available locally. Therefore, consult your regular chemical supplier for purchasing information. The following is a list of product manufacturers that can direct you to local sources of these products. This list is not necessarily complete, and the inclusion of names does not imply endorsement of a product by The Pennsylvania State University. Local laws may regulate the use of some tools and techniques and should be consulted before control activities are begun.

Repellents

Hot Sauce Animal Repellent

Miller Chemical and Fertilizer Corp.
Box 333, 120 Radio Road
Hanover, PA 17331
717-632-8921
www.millerchemical.com

Bonide Rabbit-Deer Repellent and Bulb Saver

Bonide Products, Inc.
6301 Sutliff Rd.
Oriskany, NY 13424
315-736-8231
Fax: 315-736-7582
www.bonideproducts.com

Detour Rabbit and Deer Repellent

Farnam Companies, Inc.
PO Box 34820
Phoenix, AZ 85067-4820
800-234-2269
www.farnam.com

Nibble-Not and Nott Chew-Not

Nott Products
PO Box 975
Coram, NY 11727
631-563-4455
Fax: 631-563-3950
www.nottproducts.com

Spotrete-F

Cleary Chemical Corp.
178 Ridge Rd., Suite A
Dayton, NJ 08810
800-524-1662
www.clearychemical.com

Ro-Pel Animal, Rodent, and Bird Repellent

Professional Pest Control Products
6920 Pine Forest Rd.
Pensacola, FL 32526
800-434-4555
www.pestproducts.com

Toxicants

ZP Rodent Bait AG

Bell Laboratories, Inc.
3699 Kinsman Blvd.
Madison, WI 53704
608-241-0202
Fax: 608-241-9631
www.belllabs.com/index.html

Rozol Paraffinized Pellets

Liphatech
3600 W. Elm St.
Milwaukee, WI 53209
888-331-7900
www.liphatech.com

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