

Moles

Three species of moles occur in Pennsylvania; the eastern mole, the hairy-tailed mole, and the star-nosed mole. All Pennsylvania moles have a hairless, pointed snout extending nearly $\frac{1}{2}$ inch in front of the mouth and are approximately 5 to 7 inches in body length. Moles are specialized for life underground. Their small eyes and the openings of the ears are concealed in the fur, and there are no external ears. The paddle-like forefeet are very large and broad with pronounced claws for digging. The hind feet are small and narrow with slender, sharp claws. Mole fur is short, soft, velvety, and when brushed offers no resistance in either direction. This adaptation allows moles to travel both forward and backward through the soil. (See Figure 1.)

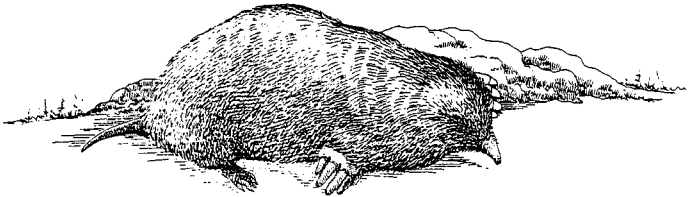


Figure 1. Eastern mole

General Biology

Moles are solitary animals that come together only to breed. The gestation period of moles is approximately 42 days. Three to five young are born in March or early April. Moles live in the seclusion of underground burrows, coming to the surface only rarely, and then often by accident. Moles have only a few predators because of their secluded life underground and may live for three to four years. Spring floods are probably the greatest danger facing adult moles and their young.

Moles are insectivores, not rodents, and are related to shrews. Their diet consists mainly of grubs, beetles, beetle larvae, and worms found in the soil. Moles eat from 70 to 100 percent of their weight each day. The tremendous amount of energy expended in plowing through soil requires a correspondingly large amount of food to supply that energy. Moles do not hibernate but are more or less active all seasons of the year. They are busiest finding and storing foods during rainy periods in summer.

Because of their food requirements, moles must cover a larger area than do most animals that live underground. Three to five moles per acre are considered a high population for most areas. Moles prefer to hunt in loose, moist soil that is rich in grubs and earthworms. This preference accounts for the mole's attraction to lawns and parks.

Description of Damage

Moles play a beneficial role in the management of soil and the control of undesirable grubs and insects. By tunneling and shifting soil particles, moles permit better aeration of the soil, help dry out sod, and enable humus (organic matter) to travel deeper into the soil. Their tunneling also allows subsoil material to be moved closer to the surface, where nutrients may be more available to plant roots.

Mole damage that is most objectionable to homeowners includes molehills and shallow tunnels. Molehills are circular mounds of dirt surrounding a vertical shaft. Molehills often exhibit round "ripple marks" made by each new load of soil that is pushed to the surface. Shallow tunnels create a heaved surface that makes lawn mowing difficult and may cause brown traces in a lawn as grass roots are damaged by burrowing activity or by exposure to air.

A mole's den area consists of irregular chambers about the size of a quart jar connected with deep runways located from 12 to 18 inches beneath the soil surface. Deep runways also lead from the mole's den to its hunting grounds. Often, the only evidence of these deep tunnels is the molehills formed as the mole excavates deep underground.

At the hunting grounds, most of a mole's runway system is made up of shallow tunnels ranging over the hunting area. These underground hunting paths are about $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in diameter. Once dug, these shallow tunnels may not be used again or they may be re-traversed at irregular intervals. Eventually, they become filled by settling soil, especially after heavy rains. (See Figure 2.)

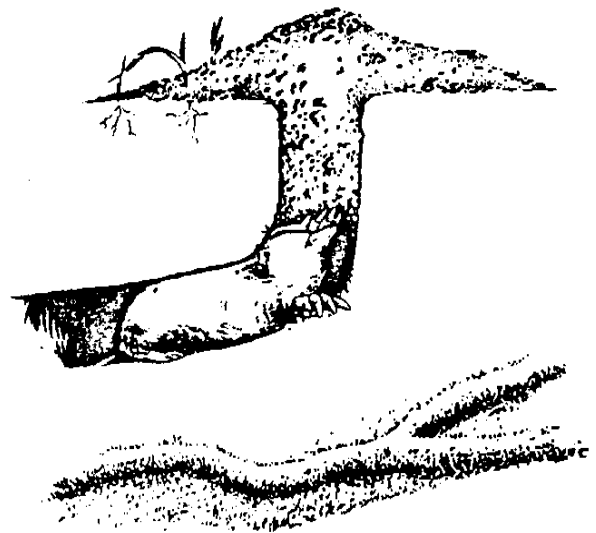


Figure 2. Mole hill and tunnels

Damage Identification

Moles are often blamed for the destruction of bulbs, seeds, and garden plants. However, moles rarely consume plants or plant parts. Plant damage is often an indirect result of the protective cover that mole passages provide for other species of small mammals. Voles, white-footed mice, and house mice live in and move through mole runways, eating and gnawing on grains, seeds, and tubers. Moles may, however, damage plants by disrupting their roots as they tunnel underneath.

It is important to properly identify the kind of animal causing damage before setting out to control the problem. Moles are most often confused with shrews and voles. (See Figure 3.) Shrews are much smaller than moles (3 to 4 inches in body length) and are mouse-like in appearance with a long, pointed snout, a short dense coat of fur, and small eyes. Shrews do not create surface tunnels but may feed in runways or tunnels of other small mammals. Voles, also called meadow mice, are about the same size as moles (4 to 6 inches in body length) with relatively large black eyes, small ears, a blunt face, and prominent orange front teeth for gnawing. Meadow voles, the most common voles in Pennsylvania, are herbivores and eat a variety of grasses, seeds, and roots. Rather than digging, voles clip grass at the base to form above-ground tunnels or bare runways through the grass. These are especially noticeable in spring when melting snow reveals the network of runways that voles used to move under the snow surface. Chipmunks may also excavate tunnels in lawns, but they do not create molehills and their deep tunnels are not visible at the surface.

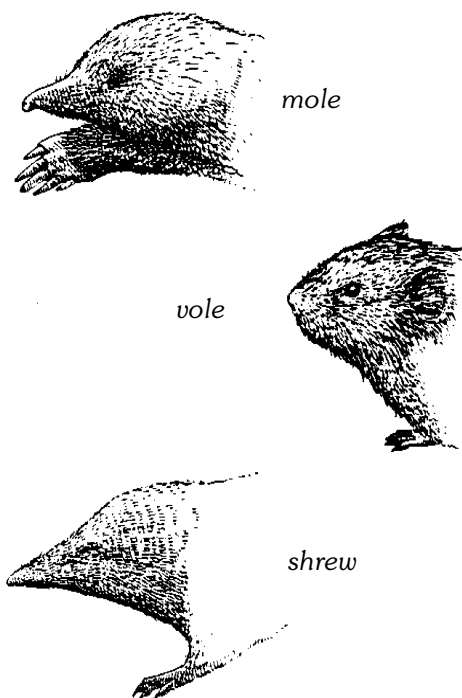


Figure 3. Mole, vole, and shrew

Damage Control

Exclusion

Fencing may be practical for small areas, such as flower and seed beds, and home gardens. Fencing should be made of 24-inch-wide sheet metal or hardware cloth. Bend the material lengthwise into an L-shape so you have two 12-inch sections at a 90-degree angle to one another. Dig a trench 12 inches deep and 12 inches wide, then bury the fence so that it is entirely below the soil surface. Position the fence so that the bottom of the "L" faces away from the area you want to protect. This will prevent moles from tunneling under the fence.

Indirect methods

A serious mole problem indicates that moles have an abundant food supply. If the food supply can be eliminated or reduced, the moles will be forced to leave the area. There are several pesticides available that will kill white grubs (June beetle larvae), other insects, and even earthworms. Inquire at your local cooperative extension office or garden center for information about an appropriate pesticide.

Caution: The use of pesticides to kill organisms in the lawn can have serious disadvantages. When the food supply is eliminated, moles may increase their digging in search of food before leaving the area, possibly increasing damage to turf or garden areas. Also, the necessary chemicals may be expensive relative to other methods, and there is usually a delay of several weeks before any effect on moles can be expected. Finally, and perhaps most important, chemical control of lawn insects and earthworms may be harmful to ground-feeding birds and other wildlife.

Milky-spore disease is a satisfactory natural control for certain white grubs. It may take several years, however, for the milky-spore disease to become established. Because moles may range over several lawns, treatments are most effective when they are made on a neighborhood-wide basis. The spore dust can be applied at a rate of 2 pounds per acre and in spots 5 to 10 feet apart (1 level teaspoon per spot). If you wish to try discouraging moles by beginning a control program for white grubs, contact your local extension office for recommended procedures.

Frightening

Some electronic, magnetic, and vibration devices have been promoted as being effective in frightening or repelling moles. None, however, have been proven effective.

Repellents

There are no chemical repellents currently registered for use on moles. Registration for Mole-Med was canceled in 2005.

Borders of marigolds may repel moles from gardens, although this method has not been scientifically tested. Mole plant (*Euphorbia latharis*) and castor bean plant (*Ricinus communis*) are often touted as a way to repel moles; how-

ever, their effectiveness is doubtful. In addition, they are poisonous to humans and can easily escape cultivation and become problem weeds.

Toxicants

Toxicants are often sold as the solution to mole problems. Usually peanuts, grain, or other food or pelleted materials act as carriers for the poison zinc phosphide. However, since moles feed almost entirely on insects and worms, they do not readily take poisoned baits, and poisoning is usually not as effective as trapping in controlling moles.

Toxicants can only be effective if placed in active burrows. To determine if a burrow is active, smash it down with your foot or remove a 1-inch section of the tunnel roof. Mark the area and recheck it in 24 hours. The burrow is active if the flattened section has been raised up or if the roof has been repaired. Treat active burrows by removing a section of the tunnel roof, dropping the recommended dose of zinc phosphide pellets into the burrow, and closing the hole with sod or stone. Take care not to collapse any section of the runway or allow loose dirt to cover the pellets.

Toxicants containing zinc phosphide are highly poisonous to all wildlife. Therefore, poison should only be applied underground (never broadcast a toxicant), and all above-ground spills should be cleaned up immediately. Collect and bury all carcasses found above ground to prevent predators and scavengers from consuming them. Finally, never apply toxicants to crop or garden areas where food or feed may be contaminated or to areas where rains may wash chemicals into ponds or streams. Because of hazards to nontarget wildlife, many zinc phosphide toxicants are registered as restricted use pesticides and can only be applied by a certified pesticide applicator.

Fumigants

Few burrow fumigants are labeled for moles, and fumigants are largely ineffective since moles can detect gases and quickly wall off the treated tunnels. Also, fumigants are only effective if the entire burrow system can be treated, often requires the cooperation of neighbors since a burrow system may extend over several lawns. Fumigants are highly toxic to wildlife, and many fumigants are restricted use pesticides that can only be applied by a certified pesticide applicator. Extreme care should be taken when using fumigants, since they are capable of causing severe burns and of igniting dry grass, leaves, and other materials. Read and follow all label instructions when using fumigants, and never use a product in a manner inconsistent with its labeling. Because of limited effectiveness in controlling moles and the associated risks, the use of fumigants is not recommended.

Trapping

Trapping is the most successful and practical method of controlling moles. There are several mole traps on the market. At first glance, the highly specialized mole traps look brutal and dangerous to the user. In fact, the sudden death of the mole in such a trap is quite humane, and a

reasonable amount of caution will prevent accidents to the trapper. The common types of mole traps are the harpoon-style trap, the scissor-jaw trap, and the choker loop trap. The harpoon trap has sharp spikes that impale the mole when the spikes are driven into the ground by the spring. The scissor-jaw trap has jaws that close firmly across the runway, one pair on either side of the trigger pan. The choker loop trap has a loop that tightens around the mole's body when the trap is triggered. (See Figure 4.)

Each type of trap, if properly handled, will give good results. The traps are set over a depressed portion of the surface tunnel. As a mole moves through the tunnel, it pushes upward on the depressed tunnel roof and trips the trigger pan of the trap. These traps are well suited to moles because the mole springs them when following its natural instinct to reopen obstructed passageways. Success or failure in the use of these devices depends largely on the operator's knowledge of the mole's habits and of the trap mechanism.

To set a trap properly, select a place in the surface runway where there is evidence of fresh mole activity and where the burrow runs in a straight line. Remember,

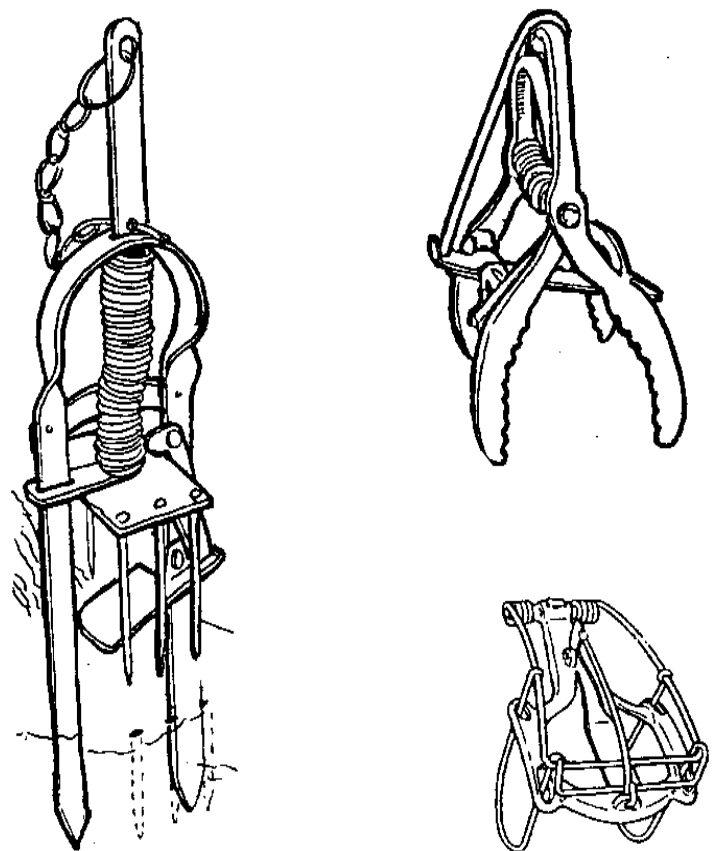


Figure 4. Types of traps

however, that many tunnels are abandoned after they are dug and only some are used regularly. Traps will only be effective if set in active tunnels. You can determine which tunnels are regularly used by mashing down several tunnels with your foot, then checking them the next day to identify which ones have been repaired. Dig out a portion of the active burrow, locate the tunnel, and replace the soil, packing it firmly where the trigger pan will rest.

To set the *harpoon or impaling-type trap*, raise the spring, set the safety catch, and push the supporting spikes into the ground, one on either side of the runway. The trigger pan should just touch the earth where the soil is packed down. Release the safety catch and allow the impaling spikes to plunge down into the ground. (This will ensure that the spikes penetrate the burrow when the trap is sprung later.) Set the trap and leave it. Do not tread on or disturb any other portion of the mole's runway. Be careful when handling this trap.

To set a *scissor-jaw trap*, dig out a portion of a straight surface runway and repack it with fine soil. Set the trap and secure it by a safety hook with its jaws forced into the ground. It should straddle the runway until the trigger pan touches the packed soil between the jaws. The points of the jaws are set about 1 inch below the mole's runway, and the trigger pan should rest on the repacked portion as previously described. Care should be taken to see that the trap is in line with the runway so the mole will have to pass directly between the jaws. In heavy clay soil, be sure to cut a path for the jaws so they can close quickly. Remember to release the safety hook before releasing the trap. Be careful when handling this trap.

To set a *choker trap*, use a garden trowel to make an excavation across the tunnel. Make it a little deeper than the tunnel and just the width of the trap. Note the exact direction of the tunnel from the open ends and place the set trap so that its loop encircles the pathway. Block the excavated section with loose, damp soil from which all gravel and debris have been removed. Pack the soil firmly underneath the trigger pan with your fingers and settle the trap so that the trigger rests snugly on the built-up soil. Finally, fill the trap hole with enough loose soil to cover the trap level with the trigger pan and to exclude all light from the mole burrow.

If a trap fails to catch a mole after two days, it can mean the mole has changed its habits, the runway was disturbed too much, the trap was improperly set, or the trap was detected by the mole. In any event, move the trap to a new location.

Live-trapping

Moles can occasionally be caught alive. Examine tunnels early in the morning or evening where fresh burrowing operations have been noted. Quietly approach the area where the earth is being heaved up. Quickly strike a spade into the ridge behind the mole and throw the animal out onto the surface. A mole occasionally can be driven to the surface by flooding a runway system with water from a

hose or ditch. Another method is to bury a 3-pound coffee can or a wide-mouth quart glass jar in the path of the mole and cover the top of the burrow with a board.

Other methods

Nearly everyone has heard of a sure-fire home remedy for controlling moles. In theory, various materials placed in mole tunnels may cause moles to die or at least leave the area. Such "cures" suggest placing broken bottles, ground glass, razor blades, thorny rose branches, bleaches, various petroleum products, sheep dip, household lye, chewing gum, Ex-Lax, and even human hair in the tunnel. Other remedies include mole wheels, pop bottles, windmills, bleach bottles with wind vents placed on sticks, and similar gadgets. Though colorful and sometimes decorative, these gadgets add nothing to the arsenal of effective mole control methods. Several electromagnetic devices have been marketed for the control of rats, mice, gophers, moles, ants, termites, and various other pests. Laboratory tests have not proven these devices to be effective. Unfortunately, there are no short cuts or magic wands when controlling moles.

Legal Status

Moles are classified as nongame mammals and are protected in Pennsylvania. However, they can be controlled when causing damage. Consult local laws for types of traps, toxicants, and other methods of damage control that can be used. It is illegal to use a pesticide in a manner inconsistent with its labeling.

Summary

Perhaps more problems are encountered with moles than with any other wild animal. Unfortunately, most people lack an appreciation of the importance of moles and the difficulty of mole control in attractive habitats. Before initiating a control program for moles, be sure that they are truly out of place. Moles play an important role in soil management and the control of grubs that destroy lawns. Their tunneling through soil and shifting of soil particles permits better aeration of the soil and subsoil, carrying humus farther down and bringing the subsoil nearer the surface where the elements of plant food may be made available. Therefore, if the individual mole is not out of place, consider it an asset. If moles are causing damage, use the methods described previously to reduce their numbers. However, control will be difficult if excellent habitat is present and nearby mole populations are high.

Facts to remember

- Trapping is the most effective mole control method.
- You must locate active tunnels.
- You have fewer moles in your yard than you think (two or three per acre at most).
- Be patient and persistent. Keep moving the traps until you are successful.
- Do not put household chemicals, chewing gum, broken glass, or other objects down burrows.

Materials and Suppliers

The following are manufacturers of mole control products. Many of these products can be purchased in local garden supply stores, feed mills, and department stores. If products are unavailable locally, they can likely be ordered from the following companies.

Toxicants (zinc phosphide) Mole-Nots Poison Peanuts

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

Moletox II

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

(chlorophacinone) RCO Mole Patrol

RCO
PO Box 191
Harrisburg, OR 97446
Tel: 541-995-7799
www.rodent-baits.com
800-214-2248 (toll free)

Fumigants Dexol Gopher Gasser

Peaceful Valley Farm
Supply, Inc.
125 Clydesdale Court
PO Box 2209
Grass Valley, CA 95945
888-784-1722 (toll free)
www.groworganic.com

Revenge Rodent Smoke Bombs

Nott Products
Company, Inc.
PO Box 975
Coram, NY 11727
631-563-4455
www.nottproducts.com

Cage and live catch traps

Woodstream Corp.
69 N. Locust St.
Lititz, PA 17543
800-800-1819
www.havahart.com
(Web site lists several local
stores that carry their traps)

Mole traps lethal

Gempler's
800-382-8473
www.gemplers.com

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