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Controlling the Eastern Mole

Rebecca McPeake
Professor - Extension
Wildlife Specialist

Introduction

Few things in this world are more frustrating than spending valuable time and money on a landscape only to have it torn up by wildlife. Moles' underground habits aerate the soil and reduce grubs, but their digging is cause for homeowner complaints.

Contrary to popular belief, moles are not rodents. Moles are insectivores in the family Talpidae (Figure 1). This animal family survives by feeding on invertebrate prey. There are seven species of moles in North America, but the Eastern mole (*Scalopus aquaticus* L.) is the species found in Arkansas.

Figure 1. Rarely seen on the surface, moles are uniquely designed for their underground existence.
Photo courtesy of Discovery Education, http://school.discoveryeducation.com.

Of all common mammals in North America, perhaps the mole is least understood. Their fossorial (underground) existence makes them very difficult to study. Still, there are basic facts known about the Eastern mole, and successful control in landscapes requires a basic understanding of their biology.

Mole Biology

Moles spend most of their lives underground feeding on invertebrate animals living in the soil. A mole's diet sharply reflects the diversity of the fauna found in its environment. The Eastern mole's diet has been found to consist of at least 52 different foods, including scarabaeid beetle larvae, ants, centipedes and earthworms (Hartman et al. 2000). A study of the stomach contents of moles (Hartman et al. 2000) found 29 species of ants that comprised 15 percent of their total food volume, but none of the ant species were the imported red fire ant (*Solenopsis invieta*). Moles lack the dental structure to chew plant material (seeds, roots, etc.) for food and, as a result, subsist strictly as insectivores (Figure 2). Occasionally moles will cut surface vegetation and bring it down to their nest as bedding, but this is not eaten.

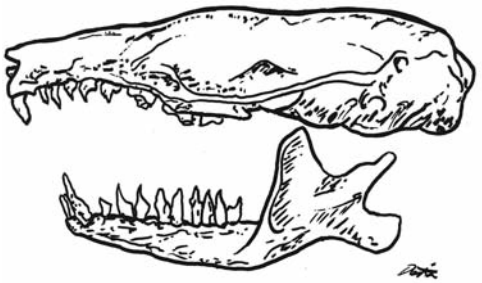

Figure 2. Moles lack the dental structure to chew plant material and subsist mostly on earthworms and other soil invertebrates.

Moles are well adapted to living underground. They have large, pan-shaped hands with long claws that allow them to move through loose soil in much the same way a swimmer moves through the water. When soils

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are dense and hard, its powerful musculature permits excavation of soil. Moles do have eyes, but they are completely covered in fur with fused eyelids. Moles also have very sensitive ears; however, there are no external signs of them.

The Eastern mole has an extremely sensitive sense of touch and can easily detect airflow, metallic objects and its prey. Their sense of smell is also well developed.

Moles live a solitary existence. They use their scent to mark territory and may fight other moles to assert dominance of an area. A mole may recolonize an abandoned tunnel system of another mole. In late winter, males will seek females to mate with, and a litter of four pups will be born and cared for by the mother. Gestation is short – about 30 to 40 days. Pups will spend 30 to 70 days in their mother's territory before leaving the nest in search of their own range. For this reason, many new infestations occur in spring.

A mole's territory depends mostly on food availability, but age and gender also play a role. Biomass is the total amount of living matter in your soil. Irrigated and fertilized lawns usually have more biomass. More biomass means more earthworms and grubs, which are the mole's food source. A British study conducted in deciduous woodlands and pastures reported a mole's territory is about ¾ to 1 acre in areas with 7 to 9 ounces of invertebrates per square yard (Gorman and Stone 1990). In fertilized lawns with higher biomass, moles probably have smaller territories, resulting in more moles per acre.

A tracking study (Harvey 1976) found the average home range of a mole was 1.8 acres, with males averaging 2.7 acres and females 0.7 acres. Typically, males' home ranges do not overlap but females' sometimes do.

Mole Tunnels

Moles dig tunnels to collect food and move from one location to another. Ritchie and Nocera (2010) reported Eastern moles were eight times more likely to be found in sites with loam or sandy loam soils than other soil textures (e.g., coarse sands, clays). A mole's tunnel system can grow into a complex three-dimensional structure over time. The surface tunnels we see are often just the tip of the iceberg.

Moles in Arkansas produce more than one type of tunnel, though there may not be all types at every site. A mole's underground activity is comprised of surface tunnels, main tunnels and nests (Figure 3).

- **Surface tunnels.** Moles can move through the top portion of the soil seeking easy-to-obtain food. These tunnels often meander throughout the yard and, because of their extent, can cause the most problems for homeowners (Figure 4). Moles are not consuming roots or plant material, but rather their tunneling action separates plant roots from soil, causing plants to die.
- **Main tunnels.** These can be subsurface or very deep and make up the permanent structure of the tunnel system. There are at least two types. The first permits the mole easy access to distant feeding areas. The second produces food on a regular basis. These tunnels are often revisited by the mole and are important to trapping. Most tunnels between feeding areas are about 6 inches below ground. Tunnels can be much deeper, however. In winter, males seeking mates will create long, straight tunnels that can be close to the surface. These are usually easy to find.
- **Nests.** Moles will build one or more nests of shredded dry grasses and leaves to sleep in, rear their young and stay while inactive during cold weather. Moles will pull plant roots or collect surface material near tunnel entrances to build nests.

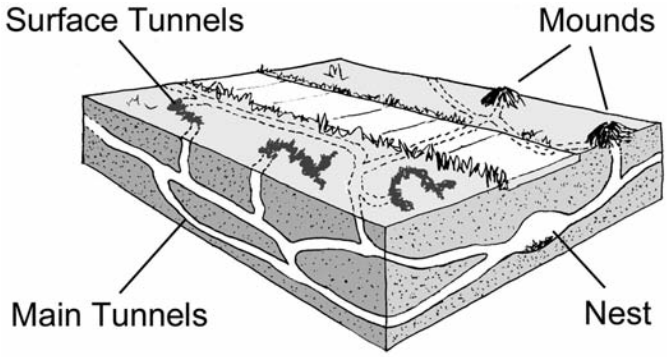

Figure 3. A mole's underground activity is comprised of surface tunnels, main tunnels and nests.

Figure 4. Moles leave surface tunnels that appear to meander. *Photo by Dustin Blakey.*

Mole tunnels serve as homes for several other species, including voles, shrews and snakes. Tunneling is most evident in spring and autumn when moles are closer to the surface. During the summer it is common for moles to forage under flower beds or dig deeper subsurface tunnels in search of food.

"Why Do I Have Moles?"

Most often it is the best maintained yards that have the worst mole problems. This may seem counter-intuitive, but it is not surprising when mole biology is considered (Figure 5).

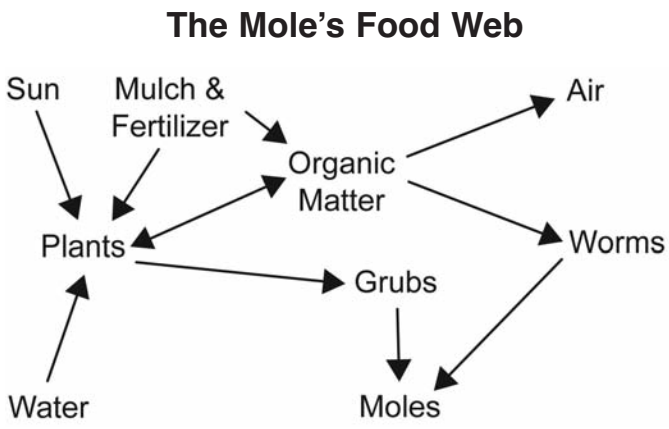

Figure 5. This food web helps explain why the best maintained yards attract moles. Yards with ample food sources provide ideal habitat for moles.

Sites with mole problems typically have two characteristics: nearby habitat for recolonizing moles and a food source to maintain a mole population. Most Arkansas landscapes are close to wooded areas that have a population of Eastern moles. As cities grow into formerly wild areas, the possibility of encountering moles will increase. Yards that attract moles are usually those that have the most inputs, namely water, fertilizer and vigorously growing plant materials. These inputs increase available biomass in a site. This in turn increases invertebrates that feed on biomass. Such rich sites can maintain a population of several moles.

Biologically speaking, moles help reduce pest problems and aerate soils. However, their digging and tunneling gets in the way of a perfectly groomed lawn but generally goes unnoticed in nonresidential areas under forest duff or plant cover. Although moles do not eat plants, sometimes their digging disturbs roots, causing plants to die.

Moles are seldom a problem in Arkansas pastures and are usually not noticed. Gophers are more likely to interfere with farm activities. Homes adjacent to pastures can be at risk as moles move in to colonize their landscape.

Identifying Mole Damage

A key part of removing a pest from a site rests on the ability to correctly identify the problem. Moles and gophers both live underground but are controlled using very different means. Therefore, it is important to learn to distinguish between damage caused by each animal.

Moles in Arkansas cause most landscape damage with surface tunnels. Mole hills are not common, but when encountered, they are less than 6 inches tall and are usually volcano- or football-shaped (Figure 6). They are made of crumbled soil, and an entrance is not evident.

Conversely, gophers produce numerous large mounds. Size and quantity is usually enough to distinguish between the two. Gopher mounds are usually kidney-shaped or fan-shaped but can be other shapes (Figure 6). In the middle is a plug where the soil has been filled into the hole. The tunnel produced by a gopher is from 2 to 2½ inches in diameter, a bit larger than a mole tunnel. Gophers may produce surface tunnels in very shallow soils, but these are unusual. Gophers eat vegetation while moles do not. Contact your county Extension agent for information about gopher control.

Control Methods

Mole control can be challenging. That is why a basic understanding of mole biology is so important.

Figure 6. Mole hills are typically volcano- or football-shaped (left), while gopher mounds are usually kidney- or fan-shaped (right). *Left photo by Dustin Blakey; right photo by Becky McPeake, University of Arkansas Division of Agriculture.*

Many folk remedies and a few scientifically-based control measures have been employed through the years. Because of the mole's complex nature, sometimes positive results have been attributed to a treatment which actually has little effect on moles. Their underground habits and response to habitat changes lead to misinterpretation of mole activity.

Folk Remedies, Scare Devices and Repellents

For as long as Americans have had gardens, there have been mole control measures. Unfortunately, these seldom work. A few of the more popular ones are discussed below.

- **Baits.** Toxic baits are not only ineffective but illegal in Arkansas. It is unlawful to poison wildlife except when controlling rats and mice (Arkansas State Game and Fish Commission Code Book 05.08). However, mole baits continue to be available in stores. Even if the product is made of highly palatable materials, there is little evidence that moles will eat them. Furthermore, their dental structure lacks molars necessary for grinding hard foods such as seeds or poison peanuts.
- **Castor beans.** Castor beans contain deadly poison, but moles are unable to eat them. Their teeth are designed for eating soil invertebrates and not seeds. Castor bean seeds pose a serious poisoning risk to children and should not be used for mole control.
- **Flooding.** Moles are excellent swimmers. To have any measure of success with flooding, a landscape would have to become a pond for an extended period. Since this is impractical, flooding is of no use. Adding water or irrigating a landscape may actually increase the moles' food supply by creating more soil invertebrates.
- **Chemical repellents.** Numerous home-brewed and commercial repellents are available to keep moles out of yards. Some repellent products have caused damage to turf in Arkansas under high stress conditions, such as extreme heat and drought. Further, it is difficult to ascertain their effectiveness, but professional mole trappers indicate they are of little benefit. A study conducted by Michigan State University researchers (Dudderar et al. 1995) reported some effectiveness with one mole control repellent containing castor oil in reducing the number of active surface tunnels. However, the study was limited in duration and number of testing sites, and researchers believed weather conditions affected mole behavior and repellent effectiveness. Further testing is needed to reach more definitive conclusions.
- **Sonic repellers.** Moles have sensitive hearing, so the theory behind these devices is to drive moles away through sound. Devices include half-buried bottles, windmills and battery-powered sound emitters of varying costs. While these devices may scare moles initially, they quickly adapt to their presence and are unaffected. Consider the number of moles that tunnel near residential heat pumps when deciding whether to try a sonic repeller.
- **Chewing gum.** This home remedy is often applied to gophers, too, where it is equally ineffective. The idea is that a mole's intestines will plug up from the gum. Some versions of this tale require the gum to be pre-chewed. None work since moles and gophers don't chew gum.
- **Gassing.** It is illegal to control moles by fumigation (Arkansas State Game and Fish Commission Code Book 05.08). Over-the-counter gas cartridges may be sold in stores; however, these are not only illegal to use but also ineffective. Fumes move too slowly, and their foul odor is detected by moles which will then block their tunnels with dirt. Moles naturally exist in a low-oxygen environment and can easily wait for the fumes to dissipate in the tunnels.
- **Physical barriers.** Excluding moles from properties using physical barriers is not generally feasible, given their ability to dig deeply.

Predation

Predation can be effective if moles are active, live in shallow soil and have a motivated predator. Terrier dog breeds are often very good at digging up moles. Cats may be effective as well (Mitchell and Beck 1992). The best time to try predation is when moles are active. Moles tend to be active two or three times a day and prefer times when it is most quiet. Borrowing a neighbor's dog may be a good first step in controlling moles. In Arkansas trials, this method has worked well if the dog was motivated, but their digging activity in pursuit of a mole can tear up a yard.

Humans can dispatch a mole easily with either an ice pick or a shovel. But since this is not enjoyable, trapping is usually employed and is more humane.

Trapping Moles

Trapping moles is the preferred method of removing moles. Good mole traps are effective and dispatch the mole quickly. Since moles use tunnels for movement and to gather food, they are compelled to keep tunnels open. This is the basis for mole trapping. Moles are caught by placing a trap, along with an obstruction, in a main tunnel.

Where to set traps. Traps must be placed in an active tunnel (Figure 7). If a tunnel dead-ends or is not used, then trapping will fail. A trap placed in an active main tunnel will usually catch a mole within 24 to 36 hours. To find active tunnels, mash the tunnel with your foot at different locations of the existing tunnel system the night before. It is not necessary or desirable to crush the entire system when setting traps. A few strategically-placed blockages are adequate. Moles will soon re-open active tunnels. The next day, place the trap at a location where the tunnel has been re-excavated. Reset the trap at a different location if nothing is caught within 24 to 36 hours.

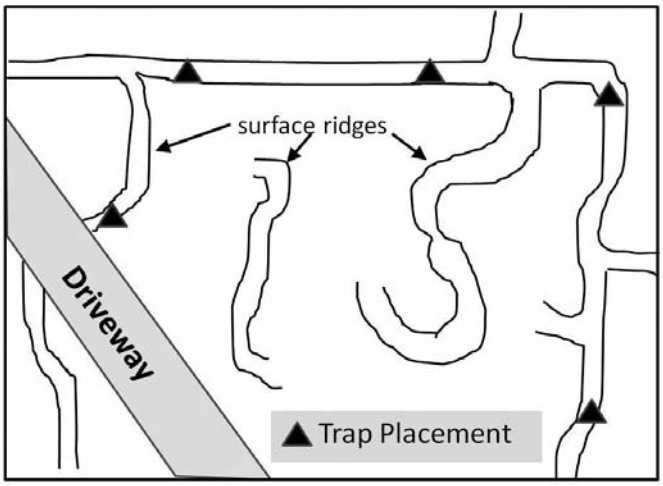

Figure 7. A network of subsurface mole tunnels in a yard. The triangles indicate a good location to set a trap. Set traps in main tunnels and avoid meandering surface ridges.

Figure 8. Examples of harpoon- and scissor-style mole traps. *Photo by Becky McPeake, University of Arkansas Division of Agriculture.*

Sometimes main tunnels are evident near the surface, especially in early spring. However, in most cases, you will find acceptable tunnels 4 to 6 inches below the surface. They are often located along sidewalks, driveways, fencerows, changes in soil texture or vegetation or along borders of flower beds (both inside and out). A broomstick can be used as a probe to find tunnels.

Types of traps. Several types of mole traps are available that vary in effectiveness and cost (Table 1). Most professional mole trappers recommend the Out-of-Sight™ scissor-jawed trap (Figure 8). Demonstration field trials using this trap in Sebastian County, Arkansas, confirm its effectiveness, particularly once the trapper gains experience with trap placement in tunnels. Harpoon-style traps are readily available in

Table 1. Various types of mole traps and their effectiveness. Some specialty types are not available locally but can be ordered from businesses on the Internet.

Trap	Pros	Cons
NoMol™	Inexpensive	Weak construction Hard to set Weak spring Takes two for each location set
Eliminator™	Automatic arming Scissor-type	Expensive Excessively dangerous, especially when wet Limited trapping depth
"English" Scissor	Inexpensive Moderately effective in trials Good around roots	Very weak construction Weak spring Requires *dry*, friable soil Occasionally misfires
Scissor-style, e.g., Victor Out O' Sight™	Moderate price Very effective in trials What pros use Strong spring Works in most soil types Has safety mechanism	Triggering difficult in organic soils (add-on choke fixes this issue) Requires some strength to arm
Choker Loop	Durable Lawn mower friendly Very safe once set	Ineffective in Arkansas trials Limited soil depth Dangerous to fingers Difficult to set properly
Harpoon-style	Easiest to set Effective in shallow systems Easy to find Time-tested design	Limited soil depth Prone to rusting Can miss young moles Fared poorly in trials
Trapline Mole Trap™ (Standard Size)	Has been effective on broad-footed moles (*Scapanus latimanus*) on the West Coast, USA Quickly dispatches animal	Takes two for each location set

home and garden stores. No digging is required for this trap's placement; however, small moles are more prone to escape. Some recommend models with spikes > 4 inches to improve effectiveness.

How to set a trap. Each trap has its own variances to this procedure, so be sure to read directions carefully. The following hints are for setting scissor and harpoon traps.

After an active tunnel has been selected, **scissor-type traps** are set by excavating a segment of the tunnel. After the soil has been removed, create an obstruction of thoroughly packed soil that is as high as the trigger on the trap. Place the armed trap over the obstruction and backfill with loose soil. Since airflow can scare moles, a bucket placed over the trap is a good way to improve success. In addition, this prevents soil from becoming saturated by rain or irrigation. Good coverage with soil can be just as effective if buckets are scarce or undesirable.

Harpoon traps are set by crushing the tunnel with your feet and arming a trap above the blockage. Select a relatively straight portion of the tunnel network to set the trap. Some illustrations of setting this trap can be misleading as they show an open tunnel below the trap. Always block the tunnel first. A bucket should be placed over these traps to keep children and pets away.

Lawn Rollers

If your concern is dying grass in your lawn from mole tunnels, use a lawn roller to press and re-connect roots with soil. A lawn roller will smooth the surface of your yard but may or may not disturb moles enough to cause them to leave. Rolling is recommended after the mole or moles have been trapped and removed.

Chemical Grub Control

Many sources recommend using grub control as a means to control moles. Since moles eat approximately 62 percent of their body weight daily, this seems reasonable. However, while it is true that moles eat grubs, they also eat worms and other invertebrates; therefore, grub control alone will likely be ineffective. Trials in Sebastian County have not shown a significant reduction in worm populations due to grub killer application.

Grub control chemicals may have an effect on the number of moles a site may feed, but it is ineffective in eliminating moles from a landscape. Anecdotal evidence suggests visible mole damage may increase as a mole hunts more vigorously to replace part of its diet. Therefore, grub control chemicals should be applied to a landscape to control grubs and not moles.

For More Information

Information on moles is scarce and is often contradictory. Here are some sources with more in-depth information on moles.

Henderson, F. R. 1994. "Moles," In *Prevention and Control of Wildlife Damage*. Inst. of Agri. and Natural Res., Univ. of Nebraska – Lincoln.

The Mole Tunnel web site. 2012. www.home.cc.umanitoba.ca/~campbelk/moletunnel.html. Research about moles of the world.

Schmidt, T. http://www.themoleman.com. Commercial web site with accurate trapping information. Cincinnati, Ohio.

References

Dudderar, Glenn R., Stacey Tellman and Dale K. Elshoff. 1995. The effectiveness of a new mole repellent for preventing damage to lawns by Eastern moles. Eastern Wildlife Damage Management Conference 7:149-152.

Gorman, M. L., and R. D. Stone. 1990. *The Natural History of Moles*. Cornell Univ. Press. Ithaca, N.Y.

Hartman, Gregory D., John O. Whitaker, Jr., and Jack R. Munsee. 2000. Diet of the mole *Scalopus aquaticus* from the coastal plain region of South Carolina. *American Midland Naturalist* 144:342-351.

Harvey, Michael. 1976. Home range, movements and diel activity of the Eastern mole, *Scalopus aquaticus*. *American Midland Naturalist* 95:436-445.

Mitchell, Joseph C., and Ruth A. Beck. 1992. Free-ranging domestic cat predation on native vertebrates in rural and urban Virginia. *Virginia Journal of Science* 43:197-207.

Ritchie, Louise E., and Joseph J. Nocera. 2010. Assessing the distribution of Eastern moles (*Scalopus aquaticus*) in Canada in relation to loam soils and forest cover. *American Midland Naturalist* 164:61-73.

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DR. REBECCA McPEAKE is professor - Extension wildlife specialist, Arkansas Forest Resources Center, University of Arkansas Division of Agriculture, Little Rock.

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