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MOLE CONTROL

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ABSTRACT: Four kinds of moles are found in the Pacific coast states but only the Townsend mole (Scapanus townsendii) in Washington and Oregon and the broad-handed mole (Scapanus latimanus) in California are considered economically important. Damage in agricultural areas is caused by mole mounds and burrow systems which reduce pasture production, make harvesting difficult by breaking or plugging machinery, contaminate hay and silage thus, retarding proper curing, contribute to soil erosion and make ready-made homes for invading meadow mice, pocket gophers, and other rodent pests. Moles also damage lawns, gardens, flower beds and occasionally eat or destroy valuable seeds and bulbs. Control methods reviewed include traps, poisoned baits, gases, soil fumigants, natural enemies, and miscellaneous methods such as mole wheels, mole plants, nest digging, and flooding.

Four kinds of moles are found in the Pacific Coast States. The Townsend mole (Scapanus townsendi i) is the largest and most important in Washington and Oregon and is common in the moist fertile soils west of the Cascade mountains. It is also found in a small area in southern British Columbia and in the north western corner of California. The broad-handed mole (S. latimanus), somewhat smaller and more silver gray or coppery brown in color, is found from the Klamath basin of south-central Oregon southward throughout much of California except for the drier desert regions. The smaller coast mole *(S.* orarius) occupies much of the same area as the Townsend mole but is found farther eastward in Washington and Oregon and northward into southern British Columbia. The fourth mole (Neurotrichus gibbsii) is called Gibbs mole or shrew-mole for the simple reason that it closely resembles the shrews in size, appearance and habits. So far as known it presents no problem to the home gardener, farmer or orchardist. In fact, though present throughout the coastal lowlands from California to British Columbia, it is nowhere abundant and is probably a beneficial rather than a harmful species. For that reason it will not be considered in this discussion which is primarily a review of methods and procedures used for controlling members of the genus Scapanus.

MOLE DAMAGE

Moles are primitive mammals belonging to the order Insectivora, the insect feeders. While they do feed on insects and insect larvae, over three-fourths of their normal diet is earthworms. Approximately 20% of their food is plant material. Silver and Moore (1941) reported that Towsend's mole eats tulips, tigridias, bulbous iris, carrots, parsnips, potatoes, peas, beans, vetch, oats, corn, and wheat and that often such items may form a substantial part of an individual animal's diet.

In spite of losses caused by the mole's food habits, the primary damage and the real reason he is considered such a pest is due to the burrowing activities of this small fossorial mammal. Wick and Landforce (1965) have summarized this damage in Oregon as follows: "Mole mounds and runways:

Cut pasture production (up to 50%) by covering grasses and legumes with mounds.

Make harvesting difficult by plugging machinery.

Break harvesting equipment (sickle blades, bars).

Contaminate hay and silage with dirt and retard curing of silage.

Make seedbed for undesirable grasses and weeds.

Cause excessive drying of plant roots and contribute to erosion.

Create ready-made homes for meadow mice.

Damage lawns and undermine turf.

Dry out shallow-rooted lawn plants and shrubs—by burrowing."

In Tiliamook County, Oregon alone the estimated losses to dairymen resulting from the burrowing activities of moles exceeds $100,000 annually (Wick, 1961).

Moles are rarely seen on the surface of the ground. In fact, they are rarely seen at all unless captured in traps or killed while burrowing near the surface. Evidence of mole activities however, is very apparent in the form of dirt piles or mounds of loose soil pushed to the surface by this busy underground engineer. Whenever and wherever he decides to excavate a new tunnel system or extend an old one, a process that seems to go on continuously, he disposes of the excess soil by the simple expedient of digging a short lateral to the surface and shoving it out on top of the ground.

The resulting mounds, though superficially resembling the dirt piles pushed up by the pocket gophers (Thomomys spp.), are usually more rounded and symetrical and are built up volcano fashion by repeated eruptions through the center of the pile. The pocket gophers generally push their dirt out to one side, like miniature bulldozers, and the resulting dump pile is a flattened semi-circle or fan-shaped pile with the plugged exit hole at one side. Thus, though similar, the workings of these two small earth movers is noticeably different, an important distinction that must be made if proper control is to be recommended or carried out for either pest.

Though the western moles (Scapanus spp.) do not seem as prone to make the many shallow surface tunnels as does the common eastern mole (Scalopus aquaticus), these often do appear in newly tilled and seeded pastures and lawns, grain fields and cultivated gardens or flower beds. Such passages are erratic, without pattern, and are formed when the mole forcefully "swims" through the upper two or three inches of loosely packed soil. These runs are characterized by a continuous shallow ridge of soil but without the usual conical shaped mounds of dirt. Sometimes called "feeder runs", they are apparently made by the mole in his almost insatiable search for food. Unlike the deeper more permanent runs, they are seldom used again. For that reason they are poor choices for placing bait, traps or other devices aim-, ed at controlling the mole.

The typical burrow system is comprised of a vast network of interconnecting tunnels and passageways varying in depth from 3 to 30 or more inches. Moles are active throughout the year and can usually be found using the tunnels from 6 to 10 inches deep. During periods of severe cold or extremely dry weather, as earthworms become scarce in the shallow surface layers of soil, the mole moves into the deeper tunnels in search of food. At such times surface burrowing activity becomes minimal and control measures are not generally too effective.

The number of mounds or ridges in any given area does not indicate the number of moles present. Silver and Moore (1941) reported one instance in which a single Townsend mole constructed 302 mounds on a quarter acre field within a 77 day period.

From I960 to 1965 the Department of Fisheries and Wildlife at Oregon State University conducted field trials involving control methods in the Tillamook County area of northwest Oregon. Most of that work was carried on in the fertile dairy pastures that were heavily populated with moles. Perhaps the most difficult part of the project was to convince the local dairy farmers that they were not dealing with insurmountable numbers and even when their pastures appeared to have been "plowed" by moles the actual population seldom exceeded 5 per acre. This maximum estimate was substantiated on several occasions during the study. Giger (1965) reported the results of one such test. During a three month period he dead trapped 552 moles from a study area made up of 12 pasture units. He quit trapping only when all surface activity ceased and it was assumed that no more moles were present. Density varied markedly between individual pastures with the range from 0.17 to 5.4 per acre. The average for all units was 2.2 per acre.

CONTROL METHODS

Just as with most vertebrate pests, controlling moles requires a thorough knowledge and understanding of the habits and behavior of the animal involved plus careful application of the best control methods and techniques available. I regret to report that we discovered no "magic wand" technique though I am sure many farmers and home gardeners hoped that we would. As Wick and Landforce (1965) pointed out, "...moles are mobile weeds". Therefore, their control must of necessity be a regular part of any farming or home gardening maintenance program. Each year we expect to fertilize, to irrigate, to prune and to spray for insect control. Why shouldn't we also expect to control mice or moles or any other vertebrate pest that decides to compete with us for our crops, our garden produce or our flowers?

The following techniques for controlling moles are neither new nor different. They can be outlined under the following broad headings:

Traps are often recommended for controlling moles in the home garden, lawn or flower beds. Generally only one or two animals are involved and a few properly set traps will quickly solve the problem with little or no hazard to pets or children. Such hazards (real or imaginary) are often associated with the use of poisoned baits of any kind.

In the Pacific Northwest the scissors-jaw trap (Out O'Sight mole trap) is the one most often used. Properly set it seldom misses (Fig. 1).

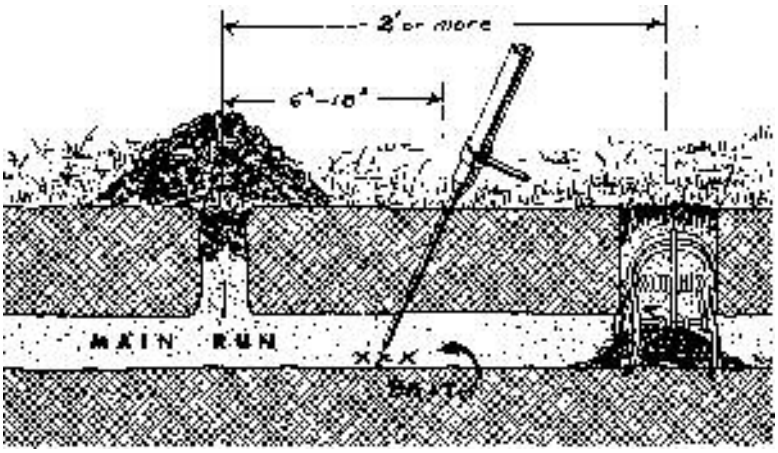

Fig. 1. The proper way of setting a scissors-jaw trap is shown at right. Note the plug of dirt under the trigger and the points of the trap slightly imbedded in the bottom of the runway. Sift fine soil around the trap Jaws to exclude light. To bait moles, probe to locate the runway, enlarge the hole by rotating the probe, insert bait through the probe hole, and close the hole to exclude light, (from O.S.U. Extension Bull. 804)

The success of this trap depends upon a firm plug of soil which is built up in the center of the opened runway for the trigger pan to rest on. The set trap is wedged firmly into the opening with the trigger resting snugly against the top of the dirt plug. Loose dirt, often from a nearby mole hill, is then sifted onto the set trap to about the level of the coil spring. This excludes light from the burrow and makes the mole less suspicious of the plugged tunnel. When burrowing through the plug to re-open his blocked burrow the mole springs the trap and is caught.

Other traps that are effective include the Diamond-jaw and the Choker-loop. The so-called "harpoon" or "spear" type traps, often used successfully for catching moles in the eastern half of the United States, have not proven as satisfactory for catching Scapanus.

Poisoned Baits:

The sense of smell must be important to the mole for identifying his food though it does not appear to be too important in helping him locate it. Taste, usually closely associated with smell in recognizing food, may also be less acute than one would expect for such a fossorial mammal. Nevertheless, it appears that the most effective rodenticide for controlling moles is those which are odorless and tasteless or nearly so. In spite of this fact, several commercial baits now being sold for mole control contain strychnine, a very bitter substance. In our control work in Oregon we have had poor to no success with strychnine baits, including decapitated earthworms dusted with strychnine. Henning (1952) claimed partial success for this latter method for controlling the common eastern mole but we have failed to duplicate his success.

Thallium sulfate meets the necessary requirements of little or no taste or odor and has been the most satisfactory of the common rodenticides tested for controlling moles in Oregon.

Dry pelleted baits containing 1% thallium sulfate and raw Spanish peanuts coated with 1% thallium have both been used.

In their Technical Release 5-66 The National Pest Control Association stated that "USDA regulatory action in 1965 removed thallium sulfate pesticides from channels of trade serving the household market. That action did not restrict the use of thallium in industrial, commercial, field or forest pest control." It did however, essentially eliminate the coated peanuts from the shelves of pesticide dealers in Oregon. Such materials can no longer be shipped in interstate commerce and apparently none are manufactured in Oregon. At least one Oregon company, licensed by the State Department of Agriculture, has been permitted to continue the manufacture of dry pelleted baits which do not contain in excess of 1.1% thallium sulfate. These are presently marketed only within the state. Field trials indicate that mole baits containing the 1% level of thallium have been the most effective poisoned baits for controlling moles in Oregon. In addition, they are available to the general public through the normal outlets of feed and seed stores or garden supply dealers. The manufacturer recently informed me that during the past 9 years over 46,000 individual packages of this pelleted mole bait have been marketed in Oregon without a single reported case of accidental poisoning to humans or non-target animals.

Proper baiting means placing the baits 6 to 10 inches beneath the ground in the mole's permanent tunnel system (Fig. 1). Generally two to four bait placements in the area of the freshest mounds is sufficient. At the 1% level it is doubtful that the secondary hazard to other animals would be significant even if the dead moles were dug up and eaten. The fact that most mammalian predators, including domestic dogs and cats, will seldom if ever eat the insectivores makes the possibility of secondary poisoning even more remote.

During the early 1950's, when compound 1080 was used somewhat more extensively in Oregon than at present, we experimented with 1080 soaked earthworms for mole control. Clean earthworms were soaked for approximately one hour in a solution made by dissolving 1/2 ounce of 1080 in 1 gallon of water. These poisoned worms were placed into the underground tunnel system with a large pair of forceps. This method proved no more effective than the dry pelleted thallium baits and was discontinued as being more hazardous and because the 1080 could not be made available to the general public.

Poisoned Gases:

From time to time poisoned gases and gas bombs are recommended as additional methods for the control of ground burrowing animals. The chemicals used include calcium carbide, calcium cyanide, methyl bromide, carbon disulfide, carbon monoxide and countless others. We have not recommended any of these for mole control simply because in the extensive tunnel system used by this small burrower he can usually take defensive action and quickly plug off the section of his burrow being gassed. Home gardeners sometimes report that they have killed the mole in their yard or garden by adding a piece of rubber hose to the exhaust of their power mower and gassing the burrow system. The fact that the mole stops working in the lawn may or may not indicate successful control. You may have only driven him across the fence to plague your neighbor. Perhaps that too is one form of control.

Soil Fumigants:

Certain insecticides including aldrin, dieldrin, chlordane and others have been suggested as beneficial for eliminating moles by getting rid of their chief source of food the earthworm. We have not found this method to be too effective and it may even be detrimental from the standpoint of good lawn culture. Earthworms are usually considered beneficial in helping to keep lawns properly aerated and even for improving fertility.

Natural Mortality:

One comforting thought for people being bothered by moles is the fact that this small mammal has a low reproductive rate and produces only about 3 young per year. The life expectancy is also low, about 3 years. At times natural causes and natural enemies may take a heavy toll. Where moles are common, as in the dairy pasture areas of western Oregon, domestic dogs and cats often become skilled at catching and killing them. This probably occurs when the mole is working in the shallow subsurface tunnels and the predator can pounce on the moving soil and quickly dig out the mole before he can retreat into the deeper tunnel system.

During May, June and July, mole remains were often found in the regurgitated pellets of the common barn owl (Glger 1965). These were mostly young animals leaving the natal nests

and scattering overland in search of new home sites.

Even the hefty Holstein cow turned "predator" on nesting moles and on many occasions destroyed nestlings by the simple process of trampling during the early spring months (Kuhn et al. 1966).

Periodic flooding during late winter and early spring months in the low coastal areas provided an occasional bonus control method in northwestern Oregon. However, many dairy farmers failed to take advantage of this act of nature and follow up with their own control measures. Moles that were not drowned or destroyed by predators quickly followed the receding waters back to their former home sites.

Nest Destruction:

In the permanent pastures in the dairy section of northwest Oregon, moles are rather plentiful and spring nest digging and the destruction of nestlings is a unique but rather effective method of reducing mole numbers. The technique has been previously reported in detail (Kuhn et al. 1966). In general it involves locating the breeding nests during the period from mid-March to mid-June, digging up the nests and destroying the young. While not a solution for most mole problems, at times it can be quite effective. In April 1961, one Tillamook county farmer located and dug out 10 nests; five containing young moles. He reported that he had destroyed as many as 100 during a single spring by this method.

Gimmicks and Gadgets;

Anyone who attempts to control pest animals is at times confused and amused by the gimmicks and gadgets, otherwise known as "sure-fire methods", that are offered by well meaning individuals who are only too glad to help. In this category are the many and varied materials recommended for placement within the burrow system. In theory such materials will cause the mole to pack up and leave the country. Included are such sundry items as broken bottles, ground glass, razor blades, bleaches, various petroleum products such as kerosene or diesel oil, sheep dip, common household lye, and even human hair.

When all of these fail, as they usually do, you may rely on mole wheels, windmills, or "klickity-klacks" (windmills with noise makers added). Though colorful and decorative, these too add nothing to our arsenal of effective mole control methods.

Some Oregon farmers have found the 12 gauge shotgun an effective tool, in rural areas where this method can be applied. This technique usually requires dragging the field to flatten all old mounds then simply patrolling back and forth until a fresh push-up indicates a mole repairing his damaged burrow system. When movement is detected in the newly formed mound a well aimed blast does the rest. The mole is either killed directly by the shot charge or indirectly by concussion.

Another cure-all is the so-called "Mole Plant" or caper spurge, Euphorbia lathyrus. When planted plentifully throughout your lawn and flower beds such plants are supposed to serve as living repellents to all members of the Insectivora. Not so!

To summarize, controlling moles, just as controlling any other vertebrate pest animal, is a challenging "maintenance" problem. Whether your goal is a velvet-smooth golf course in Seattle, a clean, level cow pasture in Tillamook, or a perfect row of lilies in Sacramento, you must know the general habits and behavior of the animal involved then be willing to apply continuous, persistent effort with proven methods and materials. A properly placed Out 0'Sight mole trap or a properly placed pellet type bait containing 1% thallium sulfate are the two most effective methods presently being used to control Oregon moles.

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