HABITS OF THE COMMON MOLE.*

Scalopus aquaticus machrinus, (Rafinesque).

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In the United States there are five genera of moles, Scalopus, Parascalops, and Condylura appear in the eastern portion; Scapanus and Neurotrichus are found west of the Rockies. Of these genera, Scalopus is most widely distributed and consequently best known and most divided into species and sub-species. Jackson, in "A Review of the American Moles," has thirteen varieties of Scalopus listed and described along with their geographical distribution. His work on moles is notable and his analytical key gives an easy means of identifying varieties, doing away with much of the confusion arising from the same variety of mole appearing in various localities under as many as twenty different names, the genera being confused as well as the species.

The mole upon which this paper is based is *Scalopus aquaticus machrinus* (Rafinesque). The observations regarding it will deal primarily with those points to which other writers have given little or no attention, or points upon which I have found conflicting statements.

Moles are often said to be entirely insectivorous. This statement, no doubt, is based upon dentition study, for the study of the stomach contents will soon prove that moles are rather omnivorous. It is commonly known that a large percent of their food is made up of earthworms which they detect in the soil through the use of the tactile hairs and the sensitive nose. I have noticed that the motion of a wriggling worm along the side of a mole will cause the latter to turn quickly and press the worm down with the front feet and the head. The mole then waits for further activity on the part of the worm, apparently depending upon this to show just where it is. If there is no further activity the mole turns its nose about in an effort to locate the worm, presumably using the sense of

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smell under these conditions. The nose is usually in motion, but it is my belief that it is through a sense of touch rather than through a sense of smell that the nose is most useful in food getting when the food taken is alive and has the power of motion.

I have found their method of eating earthworms interesting. Small worms like *Helodrilus foetidus* (Savigny) and *Helodrilus caliginosus* (Savigny) are eaten entire, but larger worms like *Lumbricus terrestris* (Linnaeus) are torn to pieces with the claws. A mole may work several minutes upon a large worm, tearing it into strips and short sections, rolling it about with the front feet and the mouth, thus getting the parts of the worm almost free from the ingested earth before eating them.

Whenever I have offered captive moles any of the insects or insect larvæ commonly found in the soil, they ate them greedily. Beetle larvæ, ants, maimed flies, and small crustacea were all eaten. Large beetles such as Lachnosterna and Lucanus were also eaten, but the wing covers and hard parts of the exoskeleton were generally refused. Prof. E. L. Mosley has found that captive moles refuse wooly insect larvæ, adult Colorado potato beetles and their larvæ. Analysis of stomachs of moles show a preponderance of earth worms, a large percentage of larvæ of Lachnosterna in season, various Carabidæ, and insect larvæ of different sorts. The most noticeable insect larvæ were those of the Elateridæ, no doubt due to the fact that their tough bodies resist mastication more than the soft bodies of other insect larvæ. In the stomachs were also found insect pupæ, earthworm egg cases, grains of oats, corn and grass. One mole taken from a clover field in December had 95% of the stomach contents made up of small ants, and since the ants were all of one species, this indicates that moles are given to plundering ant hills.

Grass found in the stomach was at first thought to have been introduced accidentally until a captive mole was found to eat grass, making as high as one-fourth of a meal upon fresh lawn clippings. This led to further experiments with wild and captive moles to find out what vegetable food they might take. It was shown, to the author's satisfaction at least, that moles are guilty in some cases of eating sprouted corn and in rare instances of eating roots and tubers. Moles in captivity, when short of water, ate Irish potatoes regularly, and would

eat freely of apples, apple being taken by some moles very shortly after they had been captured. None ever ate sweet potatoes or parsnips. One ate only sparingly of carrots. The study of marks upon partially eaten Irish potatoes has led some to say that moles could not have made them, but that they were made by mice. My observations of captive moles show that marks resembling tooth marks of mice are made by moles, both by the teeth and the claws of the front feet.

Moles in captivity will eat soaked corn readily and will live for several days upon this diet alone. When this diet has been supplemented with apples and earthworms three or four times a week I have succeeded in keeping moles alive for as long as forty-one days. Soaked wheat and oats are not as readily eaten as is soaked corn. It seems that when a mole burrows unerringly along a corn row, he not only follows the line of least resistance through the soil, provided by the mark of the planter shoe, but he also eats some of the corn along with other food found. Whether the corn is eaten or not, the young plants usually die from having their root systems torn to pieces.

Moles will usually take meat when captive, eating lean beef, fish, fresh or salted pork, mice, frogs, and even small snakes. They have no trouble in disposing of live mice such as *Microtus pennsylvanicus* (Ord) this fact making the theory that potato tubers are eaten by mice that follow along the runways of moles very untenable. In eating furry animals the mole discards most of the hair and skin, also some of the larger bones. The hind feet and strips of skin are all that are usually left after a meal upon a meadow mouse.

The mole does not ordinarily drink. I observed only one captive mole drink, taking water by lapping. In dry summer months moles may be found far from water and in such situation must depend upon the water found in their food. It would be of interest to observe moles in dry weather when earth worms are scarce or excessively deep, to see if it is then that depredations in potato patches occur. Observations upon captive specimens indicate that plant roots and tubers are eaten chiefly to satisfy thirst.

Curiously enough, no reference is made by most authors to the swimming habits of moles. Some state that the mole can

undoubtedly swim, and one author has given the mole great powers of swimming, due to powerful strokes of the great front feet. *Scalopus aquaticus machrinus* (Rafinesque.) does swim well, but the front feet play no part in propelling the animal, they are used only in turning or in righting when not on an even keel. The front feet are held together under the chin where they cut the water like the prow of a tiny motor boat, the propeller in this strange craft being the webbed hind feet which alternate with each other in their movements. The fiexible nose is held curved upwards, raising the nostrils well above the water. I have used a stop-watch upon swimming moles and find that the swimming rate averages about a foot per second. I have found the maximum speed in running to be only a little more than double the swimming rate, averaging 26.7 inches per second in the specimens tested. Both of these speeds are low, the small hind feet being poorly adapted for swimming and the large front legs so wonderfully adapted to a strong side thrust in digging are poorly adapted to running.

Moles usually bear a few external parasites, such as fleas and mites, and numerous internal parasites. Nematode worms are not uncommon in the stomach. The most common internal parasite is *Moniliformis moniliformis* (Travassos). The intestines are sometimes so clogged with these parasites that one wonders how food is able to pass along the tract. Moles containing as many as three dozen of these worms give no evidence of the fact in any way unless it be in their ravenous appetites. They must have no difficulty in supplying both themselves and their parasites with food, for even the most heavily infested moles that I observed were in good condition and seemed to have as much fatty tissue as moles not infested. Of twenty moles taken in August, 1917, the average for stomach worms was 1.2 and for intestinal worms 16.4 per animal. The intestinal worms of one animal numbered 23, their average thickness 1.4 mm. and their total length 333.5 cm. The length of the intestine of the mole was 115 cm., making the length of the enclosed parasites nearly three times the length of the intestine that held them.

The genus *Moniliformis* is placed in the subfamily *Gigantorhynchinæ* (Travassos, 1915) this being a subfamily of the *Gigantorhynchidæ* (Hamann, 1892). The members of this genus are parasites in the intestines of rodents. As far as I

know the mole has never been included in the list of hosts of this genus of Echinorynchs. If this be true it is not surprising, for I find that moles of one collecting ground may be heavily infested with the parasites, while moles a few miles away may be entirely free from them.

On account of their tunneling in lawns, flower gardens, truck patches, golf links and such places, the mole is commonly regarded as a pest. From the standpoint of his food, he is to be considered beneficial, but when a mole uproots hill after hill of melons to get the larvæ of the striped cucumber beetle projecting from the roots of the vines, the cure is decidedly worse than the disease. Once the mole finds a good feeding ground he can not be easily driven away, and if he is doing any real damage it will be found advisable to destroy the animal in some way rather than to attempt to make him seek other feeding grounds.

Experiments made by placing salt, sulphur, pepper and other irritating substances in mole runs in an attempt to drive them out of lawns and golf links have proven failures, the animal simply building another set of tunnels in another part of the lawn or golf course. One often hears that castor bean plants about a garden will keep moles away, but the writer has seen moles burrow directly under castor bean plants. Dogs can be trained to catch moles, but they will not eat them, presumably on account of their bad odor. Cats also catch moles, usually at night, they also refusing to eat the captured animal. Poisoning is one of the artificial means that may be used in reducing the number of moles, the most convenient method consisting of soaking corn, then placing strychnine or arsenic in the heart of the grain by pricking it in with a tooth-pick or other blunt instrument. The poisoned bait should be placed in the mole runways, one grain of this being sufficient to kill a mole. Care should be taken to select no poison with a decided odor, as this will lessen the efficiency of the method. I have found arsenic the most satisfactory poison to use.

The most common means of destruction, also the most efficient, is the use of traps. Traps of the nature of pitfalls have proven useless in the hands of the author, yet if they are carefully set they occasionally make a catch. Moles are often found drowned in wells walled up with boulders, but in this case it is probably thirst that causes the mole to lose his life in

this manner. Of the various spring traps set in runways, one is of equal value with another if properly set, but on account of the use to which the skins may be put, the harpoon type of trap is the least desirable.

Scalopus aquaticus machrinus (Rafinesque.) will likely continue to be an animal small in numbers among us on account of its breeding habits, for it breeds only in early spring of each year and the number at birth is small, averaging four or five. On account of its food habits and its depredations in lawns and cultivated fields, it will always be of economic value, and of special scientific interest on account of its subterranean habits and high degree of specialization.

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