MEETING THE MEADOW MOUSE MENACE

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The orchardist has many ways to lose money but one of the best is to ignore his mouse problem. This apparently insignificant, short-tailed little rodent by his unobtrusive but systematic attacks on the growing tissue of trees can be very expensive. The Indiana Extension Horticulturist has stated that mice are the number one cause for orchardists going out of business in recent years in that State. Moreover, the problem is not a recent one as a questionnaire to county agricultural agents in 1924 (Davis, 1925) showed that field mice were even then considered a problem in 40 per cent of Indiana counties.

Before effective control of any form of animal damage can be obtained, the animals involved must be properly identified. This is the basis for recognition of specific habits essential to intelligent use of control practices. However, proper coverage of the multiplicity of species and conditions that exist over the entire country would require more space than is available here. Briefly then, the main offenders are the widespread members of the genera Microtus -- pennsylvanicus in the East, ochrogaster in the Midwest, californicus in the West -- and Pitymys in the East and South. The chief difference in habits between the two genera lies in the largely subterranian existence of Pitymys or pine mice. However, Microtus ochrogaster also burrows extensively and in some areas causes damage that

is often mistaken for Pitymys. Identification of these species and information on their life history can be found in such references as The Mammals of Eastern United States (Hamilton, 1943), The Wild Mammals of Missouri (Schwartz & Schwartz, 1959), Mammals of California (Ingles, 1946), A Field Guide to the Mammals (Burt & Grossenheider, 1956), etc.

The earliest controls for meadow mice depended upon the fact that the Microtus group likes to feed under cover. Thus, Thomas (1903) recommended packing a 10 inch mound of dirt around fruit stems late in autumn to force mice to feed in the open. This principle is still recommended as a supplementary measure. However, the technique of cleaning vegetation from around tree bases has changed. Tree hoes have replaced the laborious task of hand "scalping" the sod from directly around the tree bases. An even newer modification is the use of weed killers, such as Monuron and Diuron (Holm, Gilbert & Haltvick, 1959) which give complete control of the vegetation for periods up to three years after the first application.

The next approach was to protect individual trees with some form of guards. The materials recommended have included wire netting, wooden lath, tar paper, clay tile, expanded aluminum mesh, etc. Chemical repellents, such as creosote, coal tar or lime sulfur (Silver, 1930) have generally been unsuccessful but recently Besser & Dutton (1960) report success with this technique using thiram compounds (ABASAN). These are applied to the base of the tree above the expected snow level and into the ground to a depth of two to six inches. The value of this method, however, remains to be proven under a variety of conditions.

Two methods of minimizing mouse damage that have numerous adherents but little factual support include baiting mice with prunings and natural predation. Piling prunings under tree bases will furnish food for mice but rarely does it divert damage during a difficult winter. Many orchardists lay the blame for their mouse troubles on upsetting "the balance of nature". They believe mice are kept under control by the steady pressure of predatory reptiles, birds and mammals. This ignores the fact that an orchard is an artificial environment, usually more attractive to mice than to these predators. Further, that natural control by predators on a prolific species like mice, merely serves to remove surplus numbers. As in all cases, be it deer, fox, or mice, man is the most efficient predator of them all.

Gas is probably the least effective of the reductional controls available. As most gases must be concentrated in order to build up lethal amounts in the atmosphere, this technique is more practical against burrowing species like Pitymys and Microtus ochrogaster. Gases that have been used are calcium cyanide (Woodside, et al, 1942), carbon dioxide from tractor exhausts and chloropicrin (Anon., 1920). In the writer's opinion, this is a too expensive and ineffectual technique to be of any serious value.

Trapping on a large scale is rarely practical. However, for small orchards it can be a cheap, effective practice. The preferred method is to use a number of wooden-based snap traps baited with cut pieces of apple and/or rolled oats. These are set perpendicular to active runways

so that only the bait pan lies in the runway. Hudson & Solf (1959) have recommended sinking six-inch diameter fruit cans into the ground. Holes are punched halfway up the can to keep them from filling completely with water but they are filled to this point in order to drown the mice quickly. Peanut butter and rolled oats are smeared in the can about an inch from the top.

The best reductional control is the use of chemical pesticides. Arsenic and strychnine were the first toxicants to be used (Surface, 1905). While the first has been dropped, strychnine is still used by many orchardists. However, zinc phosphide is considered the best of the common rodenticides for mouse control. Strychnine causes violent convulsions within fifteen minutes after ingestion which interferes with feeding and sublethal amounts can result in a tolerance to the chemical. On the other hand, zinc phosphide is slower acting and develops no tolerance. Applications of both toxicants lose effectiveness if they are repeated within six months.

The hazard of exposing deadly poisons in the field, along with the knowledge that mice feed better under cover encouraged the early development of bait stations. These were usually tiles, tar paper cylinders, bottles, tin cans and other containers in which bait, usually strychnine-oats, was placed. However, it was later found that the hazards to other animals were less than first imagined. Also, mice feed better if bait is placed in their normally travelled paths under some natural cover. Thus, the practice of trail baiting evolved. This method, using zinc phosphide-apples, is one of the most effective control measures available and is still

recommended by the Bureau of Sport Fisheries and Wildlife. Unfortunately, it involves considerable hand labor and is hard work. The rising costs and general unavailability of labor in orchards have forced growers to seek more mechanical methods. The first of these was introduced in New York State by Dr. Eadie (1949). This consisted of a little hand planter set so that it spread two pounds of 2 per cent zinc phosphide-corn per acre. The planter was pushed through an orchard on a grid pattern (four sides of the tree) just under the drip line.

Shortly afterwards, Branch of Predator and Rodent Control personnel in the East developed another mechanical bait dispenser known as the "trail-builder" (Anon., 1953). This is a welded metal frame in the shape of an "L". At the point of the "L" is a heavily weighted plow disc, followed by a "torpedo" that punches a two-inch diameter tunnel about three to four inches below the surface. Bait is dropped into this tunnel before the sod drops back into place, by a man sitting on the trail-builder or by an automatic bait dispenser (Anon., 1958). The method takes advantage of an apparently universal animal trait — curiosity over freshly-turned earth. Mice move readily into these passage ways and excellent control can be obtained where the machines are used as recommended. The preferred bait is zinc phosphide-apple but grain bait can be applied in this fashion. Limitations of the trail-builder are the difficulty of using the rig in rocky or very hilly orchards, and the need for optimum sod cover and soil moisture conditions to permit it to cut and pack attractive tunnels. Its use has not been as thoroughly publicized, except in the Northeast, as the value of the method warrants.

The effect of toxaphene ground sprays on mouse populations was first noted by Garlough (1950). Later, field studies showed that endrin was a more effective toxicant particularly where pine mice were present. (Horsfall, 1954). From the horticulturist's viewpoint, the application of a spray material directly on the orchard floor to control mice offers the ideal solution to the problem. The orchardist has the necessary equipment, knowledge of materials and trained labor to do this type of work. Consequently, many commercial orchards have readily adopted endrin ground spray as a standard orchard practice. Spraying is usually done with an 11-foot horizontal ground boom or, in rough country, a 45° angle boom. Emulsifiable concentrate endrin (1.6 pounds per gallon) is sprayed at a rate of 3 pints per 100 gallons on a 670-foot strip. The latest suggestion (Rollins & Horsfall, 1961) is to increase the dosage to 6 pints of concentrate per 100 gallons of water. However, this is sprayed on one side of the tree only rather than two sides as with the weaker dosage.

The Bureau has not recommended this method. Problems include potential hazards to other forms of wildlife, domestic animals and the operator, besides the unknown effect of pouring a highly toxic material on the same ground year after year. While the run-off of endrin can be lethal to fish populations (Tarzwell, 1959), reported direct wildlife losses have been relatively few. However, the indirect effect of area sprays with chlorinated hydrocarbons on bird populations (DeWitt, et al, 1960; Wallace, 1959); etc.) suggests that we may be building bigger headaches for the future.

Endrin is probably the best control measure in use today against Pitymys but it is losing favor at least in some Midwestern areas (Fitzwater, 1961). The reasons for this are its excessive costs and, at times, poor results. Where Microtus spp. alone are involved the technique of broadcast baiting appears about as effective and considerably cheaper. In broadcasting bait, a reasonable compromise has been found between laborious trail-baiting and the "shotgun approach" of endrin ground sprays. The bait used is generally a 2 per cent grain bait (oats, corn or a combination of both) applied at the rate of 6 to 10 pounds per acre (Fitzwater & Oderkirk, 1961). It can be dispersed by airplane or a tractor-drawn seeder or fertilizer spreader. However, broadcasting by hand is preferred as it permits concentration of the bait into the heaviest mouse cover rather than thinly spreading the bait along the tree rows. The method compares favorably with other methods as to effectiveness and its cost is considerably below that of trail baiting and toxic sprays. The hazards and effects on other animals and birds are considerably less than for the toxic ground sprays.

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ORCHARD MOUSE TRAIL BUILDER

COMPARISON OF GIRDLING ON LARGE APPLE TREE BY RABBITS (above) AND MICE (below)

BROADCASTING ZINC PHOSPHIDE GRAIN BAIT BY HAND