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## Epizootiology of Trichiniasis in Wildlife From a Southcentral Iowa Area<sup>1</sup>

W. J. ZIMMERMANN, E. D. HUBBARD, L. H. SCHWARTE and  
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*Abstract.* Sixteen species of wildlife, comprising 1,925 specimens, were examined for *Trichinella spiralis* during the 1953-1960 period. Species found to be infected with parasites were rat, fox, mink, raccoon, and badger. Initially a high incidence of trichinae was found in the rat, fox, and mink, followed by a marked decline. There is some evidence of a cyclic occurrence in mink. The possible significance of wildlife reservoirs as vectors of trichiniasis to grain-fed swine is discussed.

The persistence of a low incidence of *Trichinella spiralis* in grain-fed swine indicates that this parasite is disseminated by means other than garbage feeding. In order to determine the possible sources of infection for grain-fed swine, studies were initiated during the 1953-54 hunting and trapping season to ascertain the possible existence of wildlife reservoirs of *Trichinella* in an area of south-central Iowa from which numerous specimens were made available. In 1955 the studies were expanded to include nine additional areas of Iowa. This report is based on the studies from the southcentral Iowa area which continued through the 1959-60 season. Zimmermann, Schwarte, and Biester (1956) and Zimmermann, Hubbard, and Biester (1959) reported studies of trichiniasis in Iowa wildlife extending through the 1956-57 season. Eight species of wildlife which were found to be carriers of trichinae are the rat, mink, fox, striped skunk, spotted skunk, opossum, raccoon, and coyote. These were apparently the first reports of *T. spiralis* in the wild mink, opossum, and spotted skunk. Two or more infected species were found from nine of the 10 sampling areas.

Investigations were made to determine possible relationships between infected wildlife and grain-fed swine in the trichiniasis cycle. Two modes of transmission were considered: (1) direct consumption of infected wildlife by grain-fed swine, and (2) fecal transmission from infected to susceptible animals. Rats and mice may occasionally be eaten by swine but other species would be less readily available. Zimmermann, Hubbard, and Mathews (1959) found that fecal transmission could occur under experimental conditions, a high percentage of transmissions occurring within the first

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24 hours after infection of the donor animal. Other controlling factors were size of infective dosages administered to the donor animal and relative immunity of the donor animal.

MATERIALS AND METHODS

Sixteen species of wildlife, comprising 1,925 specimens, were examined for *T. spiralis*. In addition to wildlife specimens obtained during the hunting and trapping seasons, rats were obtained from a city dump at various times during the study period. Since most of the wildlife were obtained during the November to February periods, the yearly sampling intervals indicated in this report are from July 1 through June 30.

Tissues selected for examination varied with species. The diaphragm, tongue, and leg muscles were examined from the larger mammals, whereas the entire skinned and eviscerated carcasses of rats and bats were used. Breast muscle was obtained from birds. Tissue samples were ground in individual food choppers; then 45-gm. samples were examined for trichinae by the artificial digestion-Baermann technique.

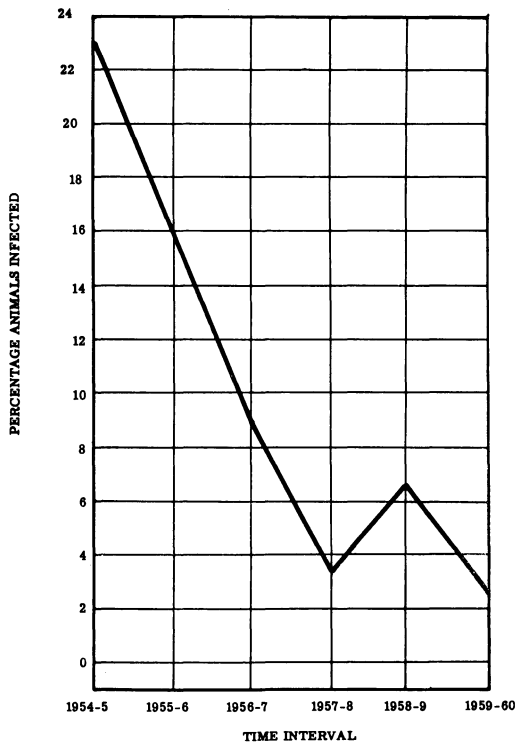


Figure 1. Prevalence of trichiniasis in rats.

## RESULTS

**Brown rat (*Rattus norvegicus*).** All rats examined for *T. spiralis* were obtained from a city dump in southcentral Iowa. The initial group of rats was obtained in May, 1955, followed by a second group in March, 1957. Subsequent groups were examined at two- or three-month intervals until the dump was converted to a landfill type in July, 1959.

Seven percent of the 801 rats examined during the study were infected with *T. spiralis*. The prevalence in the initial group was high, 23 percent of the 61 rats being infected (Figure 1). A decreased incidence of infection was found in the four following periods of study. The incidence declined to 8.7 percent during 1956-57, followed by 3.4, 6.6, and 2.4 percent in the three remaining intervals. Consecutive samplings of November, 1957, and February, 1958, as well as those of December, 1958, and February, 1959, yielded no infected rats, indicating that trichiniasis was at its lowest level during the winter season.

Although not an accurate guide to the intensity of infection, some indication may be obtained by larval counts from 45-gm. (0.1 lb.) tissue samples. In the case of rats only, this included bones. The maximum larval count from rats was 850,000. Another sample contained 454,000. Sixteen of the 56 infected rat samples contained more than 10,000 trichinae, whereas 27 contained less than 1,000.

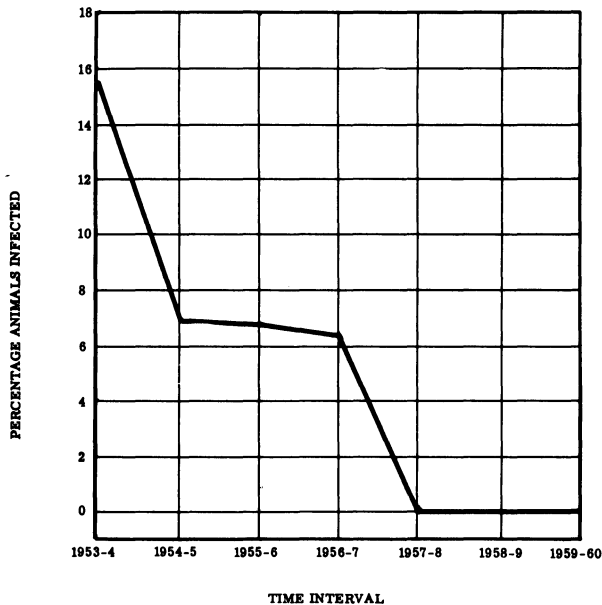


Figure 2. Prevalence of trichiniasis in foxes.

Red fox (*Vulpes fulva*) and grey fox (*Urocyon cinereoargenteus*). Foxes examined were primarily red foxes. No attempt was made to differentiate species. During the seven seasons of the study, 431 foxes were examined and 30 (7.0 percent) were found to be infected. A definite downward trend in incidence was noted (Figure 2). During the initial season, 1953-54, 15.5 percent of the 58 foxes examined were infected with *T. spiralis*. The incidence of infection decreased to 7.0 percent in 1954-55, followed by 6.9 and 6.6 percent during the 1955-56 and 1956-57 seasons, respectively. No infected foxes were obtained from the study area during the 1957-1958, 1958-59 and 1959-60 seasons.

The maximum larval count from foxes was 2,000. Two other counts were over 1,000. Fourteen of the 30 infected samples contained less than 100 trichinae. Forty-eight fox cubs were examined, with no trichinae being recovered.

Mink (*Mustela vison*). An overall prevalence of 10.1 percent was found in the 198 minks obtained from the study area during the seven seasons. The infective pattern during the first four seasons was similar to that found for rats and foxes, i.e. a high initial prevalence followed by a decline (Figure 3). During the first sea-

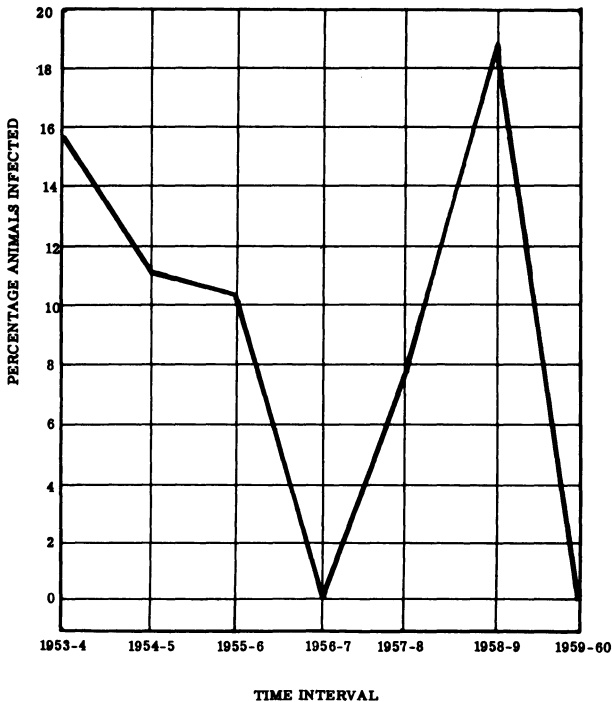


Figure 3. Prevalence of trichiniasis in minks.

son the prevalence was 15.8 percent, followed by 11.1 percent in 1954-55, and 10.3 percent in 1955-56. No infected minks were obtained in 1956-57. During the next two seasons an upswing in prevalence occurred, rising to 7.4 percent in 1957-58 followed by an additional increase to 18.8 percent in 1958-59. During the 1959-60 season no infected minks were obtained from the study area.

The number of larvae recovered from 45-gm. samples of mink was generally high. Only four of the 20 samples from infected animals contained less than 1,000 larvae. Ten of the samples contained more than 10,000 trichinae, the maximum being 57,000.

**Raccoon** (*Procyon lotor*). Only one (0.5 percent) of the 203 raccoons examined was found to be infected with *T. spiralis*. The infection was light; 39 trichinae were recovered. No raccoons were obtained during the last two seasons of the study.

**Badger** (*Taxidea taxus*). The only badger obtained from the study area was infected with *T. spiralis*. Nine trichinae were recovered from the tissue sample. The badger is the ninth species of wildlife from Iowa which has been found to be infected with this parasite.

**Other species.** In addition to the five species of wildlife which were infected with *T. spiralis*, other species were examined with negative results. These species, with the number of each examined, are as follows: bat (1), beaver (7), coyote (1), crow (20), hawks (6), muskrat (128), opossum (60), spotted skunk (4) and striped skunk (14).

#### DISCUSSION

Although garbage feeding is at a minimum in the corn belt area, the finding of five wildlife species infected with *T. spiralis* from a limited area in southcentral Iowa emphasizes the problems to be faced before this parasite can be eliminated as a human health hazard. Earlier studies found infected wildlife in all the ten areas of Iowa which were checked. This indicates that trichiniasis in wildlife is not a limited problem, but one in any area which harbors wildlife. It is impossible, from both a practical and conservation standpoint, to attempt to eliminate all wildlife species which may be reservoirs of trichinae.

Although the rats examined from this area were all dump rats, the high incidence tends to stress the importance of rats as potential vectors of trichiniasis to grain-fed swine. Rats are present on nearly all Iowa farms. Infected rats could be the source of *T. spiralis* in swine either through consumption of rats by pigs or by fecal transmission. Any infected rat carcass in a swine maintenance area

could be the source of infection for one or more pigs. Therefore, even on farms where rat control measures are applied, all dead rats should be removed from areas to which swine have access. This would apply also to mice.

The possibility of rat or mouse fecal transmission should also be considered. Rats or mice may defecate in swine feeding areas. Fecal contamination of stored swine feed may also occur.

Foxes may also have a role in the perpetuation of trichiniasis in grain-fed swine through the medium of feces. Foxes are habitual wanderers at night, sometimes entering hog lots. Although there is a relatively high incidence of trichiniasis in minks, they are less apt to be found in swine feeding areas. The relatively low prevalence in raccoons would lessen their importance. A larger sample of badgers is needed before their importance can be determined.

A rather similar pattern of infection was found in the rat, mink, and fox. There was a high initial prevalence followed by a rather marked decline. The marked decline in rats during the twenty-two month interval between the first and second samplings indicates a decrease in number of viable trichinae present in garbage. This may be partially a reflection of the regulations governing the feeding of garbage which became effective in nearly all states during the 1953-55 period. This would also tend to explain in part the decline of trichiniasis in fox and mink. Although garbage would be only a minor portion of their diet, they do eat numerous garbage-feeding rodents.

There is an indication of a cyclic pattern of infection in mink (Figure 3). The reason for this is unknown, but it may reflect cyclic changes in the population of small rodents.

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