The occurrence of Mesocestoides sp. in British wild red foxes (Vulpes vulpes crucigera)

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ABSTRACT
Infection with the cyclophyllidean tapeworm Mesocestoides sp. is recorded in British wild red foxes (Vulpes vulpes crucigera) from Scotland and South East England. Previously, the occurrence of this parasite in Great Britain has been rarely reported, but the results of the present study indicate that vulpine infection may be common.

Numerous reports of the cyclophyllidean tapeworm Mesocestoides spp. in the domestic dog, a variety of sylvatic carnivores, and birds have emanated from many countries throughout the world (Warlde and McLeod, 1952; Soulsby, 1965). In Great Britain, however, this parasite has been infrequently recorded.

Soulsby (1965) states that this tapeworm does not normally occur in dogs in Great Britain, but records that it was found on one occasion in a fox in Scotland. Prior to this finding, Beresford-Jones (1961) reported the occurrence of Mesocestoides sp. in 7 of 300 wild red foxes from 27 counties in Scotland, England and Wales, but he did not state the exact origin of the infected foxes. Dunn (1969) has also reported the recovery of the adult tapeworms from wild red foxes in Britain, as well as the larval stages from domesticated rabbits. Other surveys on the helminth fauna of British foxes have not revealed the presence of this parasite (Watkins and Harvey, 1942; Blackmore, 1964; Cook, 1965—Ph.D. Thesis, University of Liverpool).

Recently, foxes have been examined in order to assess their role in the epidemiology of hydatidosis in Great Britain (Thompson, 1975—Ph.D. Thesis, University of London; Thompson and Smyth, 1975). Mesocestoides sp. was found more frequently in these foxes than expected for a parasite assumed to be uncommon in this country, and it therefore seemed desirable to provide further data on this subject.

MATERIALS AND METHODS
All fox material was made available through the co-operation of the Ministry of Agriculture, Fisheries and Food. Intestines were removed from the carcasses of 52 wild red foxes (Vulpes vulpes crucigera). They were immersed in 10% formalin and sent to the author in polythene bags. The origins of the foxes involved in this study are shown in Table 1.

In the laboratory, the intestines were slit open and any visible helminths removed. The intestines were then carefully scraped and the scrapings examined.

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For morphological studies, worms were examined whole, either mounted in lactophenol or stained in acidified Gower’s carmine, or as sections stained in haematoxylin and alcoholic erythrosin.

RESULTS

The intestines examined had not been injected with 10% formalin, but had only been immersed in this fixative for transit to the author. Internal fixation of the gut was poor, and the helminths recovered were in poor condition for measurement and morphological study, being brittle and usually distorted and shrunken. Their staining affinity was also impaired.

**TABLE 1**

The occurrence of *Mesocestoides* sp. in foxes from various areas of Great Britain. All foxes examined were British wild red foxes (*Vulpes vulpes crucigera*).

<table>
<thead>
<tr>
<th>Origin of foxes</th>
<th>No. intestines examined</th>
<th>No. infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Scotland</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>East Scotland</td>
<td>17</td>
<td>4</td>
</tr>
<tr>
<td>Central Scotland</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Mid Wales</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>South East England</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>52</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

However, in the small intestine of 9 of the 52 foxes examined (Table 1), tapeworm specimens were found that possessed morphological characteristics consistent with descriptions of the genus *Mesocestoides* (Wardle and McLeod, 1952; Soulsby, 1965).

The scolex was large and devoid of a rostellum and hooks, but possessed four oval suckers (Fig. 1). In mature segments, only a single set of reproductive organs was present, and the single genital pore opened ventrally. Testes were numerous, and distributed on both sides of the osmoregulatory canals. The characteristic single thick-walled paruterine organ was observed in the terminal segments (Fig. 2).

The number of specimens recovered from each fox ranged from one to approximately twenty. All worms were found in the second quarter of the small intestine, and when large numbers were present individuals were “knotted” tightly together.

DISCUSSION

Morphological features consistent with descriptions of the genus *Mesocestoides* (Wardle and McLeod, 1952; Soulsby, 1965) have been observed in cestode specimens removed from the small intestine of nine wild red foxes (*V. vulpes crucigera*). The parasite was recovered from foxes in Scotland and Southern England (Table 1).

Although only a limited amount of morphological data was obtained in this study, the species of *Mesocestoides* found is probably *M. lineatus*. A more reliable specific identification of the genus occurring in British wild foxes will be possible once fresh specimens have been examined. This is particularly desirable because the classification and speciation of this genus is rather controversial. Numerous separate species have been described, but Witenberg (1934) considers all those that occur in carnivores to be variants of the single species *M. lineatus.*
FIG. 1. Scolex of *Mesocestodes* sp. from the small intestine of a British wild red fox. The scolex of this genus has 4 oval suckers, but lacks a rostellum and hooks.

FIG. 2. Gravid segment of *Mesocestodes* sp. from the same source, showing the thick-walled paruterine organ (arrowed) containing hexacanth embryos.
Mesocestoides in British foxes

The life cycle and transmission of Mesocestoides is not fully understood, but it is thought that two intermediate hosts are required for the completion of the life cycle.

The first intermediate host is a coprophagous arthropod, and Soldatowa (1944) has shown experimentally that oribatid mites (Trichoribates spp.) can serve as such. A cysticercoid develops in the body cavity of the oribatid mite, and when this is eaten by the second intermediate host the cysticercoid becomes a tetrahyridium. The second intermediate host is a vertebrate, which can include the dog, fox, cat and various birds, reptiles and amphibians. Tetrahyridia occupy the peritoneal or pleural cavities, and when eaten by the definitive host develop to maturity in the small intestine in approximately three weeks (Soulsby, 1965). In the present study, the remains of birds and small mammals were routinely found in the fox intestines examined, and in one case fragments of a reptile skin were found.

The frequency with which British foxes could be expected to catch and eat suspected intermediate hosts, and the common occurrence of the parasite in the small number of foxes examined here, indicates that Mesocestoides infection in the fox may not be unusual. The parasite has also been shown to occur in foxes from two widely separated areas of Great Britain (Table 1). In the past, investigators may well have confused infections of Mesocestoides with those of Diphylidium, a confusion that was considered probable regarding infection in dogs in North America (Williams et al., 1975).

Clearly, the presence of this interesting yet poorly understood parasite in the British wild red fox provides a useful opportunity to study the epidemiology of this parasite, especially since it is now recognized as a human pathogen (Chandler, 1942; Chandler, 1949; Fain and Herin, 1954; Gleason and Healy, 1967; Tanaka et al., 1967; Choi et al., 1967; Gleason et al., 1973).

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REFERENCES


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