J. Hyg., Camb. (1976), **77**, 51
Printed in Great Britain

Salmonellosis in wild mammals

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(*Received* 18 *November* 1975)

SUMMARY

One thousand two hundred and sixty-nine freeliving, wild mammals, representative of 16 species from estates in Berkshire, Oxfordshire and Surrey, were examined for the presence of salmonellas. *Salmonella typhimurium* was isolated from 1 and *S. dublin* from 7 house mice (*Mus musculus*). There were no isolations from the other species examined. It was concluded that the house-mice infected with *S. dublin* acquired the organism from experimentally infected cattle.

The wild mammal population does not at present appear to constitute a reservoir for infection of domestic animals.

INTRODUCTION

The literature on salmonellosis in animals has been reviewed by Buxton (1957) and Taylor (1968). A relation has been demonstrated between the incidence of *Salmonella dublin* infection in cattle and the presence of in-contact rats (*Rattus norvegicus*) which showed an 8% infection rate (Gibson, 1958). However, on non-infected premises the rate of infection amongst rats was only 0·6% and Gibson (1961) concluded that this acquisition of infection amongst rats might merely prolong infection on premises for a short period after the original infection in the cattle had subsided. Similar figures for the house-mouse are not available, but Taylor (1968) suggested that infection in the mouse is comparatively rare. This was shown by Brown & Parker (1957) who examined 73 mice caught on ships in Manchester and isolated *S. typhimurium* and *S. stanley* from two. However, in the rest of the city only one isolation was made from 291 mice and this was a strain of *S. enteritidis* which had been laid as a rodenticide.

Less information is available on salmonellosis among other wild, free-living mammals in Britain. Small mammals, particularly the house mouse, are often suggested as possible vehicles for the spread of *Salmonella* to the human or domestic animal population and the purpose of the work described here was to establish the rate of infection amongst several mammal species in a rural environment with special reference to the infection rate amongst house mice associated with farm buildings.

Table 1. *Wild, free-living mammals examined for salmonellas*

Species	How obtained	Tissues examined	Number examined
House house (*Mus musculus*)	Trap	Liver, spleen, intestines	364
Brown rat (*Rattus norvegicus*)	Trap	Liver, spleen, intestines	1
Wood mouse (*Apodemus sylvaticus*)	Trap	Liver, spleen, intestines	114
Bank vole (*Clethrionomys glareolus*)	Trap	Liver, spleen, intestines	110
Short-tailed vole (*Microtus agrestis*)	Trap	Liver, spleen, intestines	25
Water vole (*Arvicola amphibius*)	Trap	Liver, spleen, intestines	5
Grey squirrel (*Sciurus carolinensis*)	Shot	Liver, spleen, intestines	26
Brown hare (*Lepus europaeus*)	Shot	Rectal contents	404
Rabbit (*Oryctolagus cuniculus*)	Shot, netted	Rectal contents	100
Common shrew (*Sorex araneus*)	Trap	Liver, spleen, intestines	99
Mole (*Talpa europaea*)	Trap	Liver, spleen, intestines	7
Hedgehog (*Erinaceus europaeus*)	Caught	Liver, spleen, intestines	7
Stoat (*Mustela erminea*)	Trap	Liver, spleen, intestines	1
Weasel (*Mustela nivalis*)	Road casualty	Intestines, rectum	1
Badger (*Meles meles*)	Found dead	Liver, spleen, intestines, mesenteric lymph nodes, rectum	2
Fox (*Vulpes vulpes*)	Shot, found dead	Liver, spleen, intestines, rectum	3
		Total	1269

MATERIALS AND METHODS

Specimens from 16 species of wild free-living mammals were collected between November 1972 and November 1975. House-mice were collected mainly from the buildings of the isolation compound at the Institute for Research on Animal Diseases. During the period of collection *S. typhimurium* was present in calves in the buildings, and one building was used to house cattle experimentally infected with *S. dublin*. The majority of specimens of other species were obtained from the Institute estate and neighbouring estates in Berkshire. Other specimens were obtained from estates in Surrey and Oxfordshire. The dairy herds grazing on land adjacent to collection sites were not known to be infected with salmonellas.

The number of animals of each species examined, how they were obtained and the tissues sampled are shown in Table 1.

A portion of each tissue was streaked over the surface of modified brilliant green agar (Oxoid) containing 120 mg./l. sulphadiazine (BDH) and approximately 1 g. portions of tissue were enriched in Rappaport broth (Rappaport, Konforti & Navon, 1956) and Difco selenite brilliant green broth (SBG).

The Rappaport broths were incubated at 37° C. and the SBG at 43° C. After 24 and 48 h. incubation all broths were inoculated on modified brilliant green agar (as above). Plates were incubated at 37° C. and examined after 24 and 48 h. Non-lactose and sucrose fermenting bacteria resembling salmonellas in colony morphology were identified biochemically according to the method of Edwards & Ewing (1962) and serologically according to the method of Kauffmann (1972). Strains of *S. dublin* were biotyped according to the method of Walton (1972).

RESULTS

S. typhimurium was isolated from 1 and *S. dublin* from 7 house mice. No isolations were made from the other species examined.

Six of the house-mice from which *S. dublin* was isolated were obtained from a building used to house cattle experimentally infected with *S. dublin*, and the seventh was obtained from an adjacent building. The 7 strains were of biotype C (Walton, 1972) and this was also the biotype being used to infect the cattle.

DISCUSSION

The isolation of *Salmonella* from only 8 wild, free-living mammals indicates that the infection rate amongst such animals is extremely low especially since 7 of the isolations can be explained by contact between house-mice and experimentally infected cattle. The strain of *S. typhimurium* was, however, of a different phage type from those infecting calves at the time of collection of specimens.

A further 28 house-mice were collected from the building housing experimentally infected cattle perhaps indicating that even when exposed to the organism house-mice are not easily infected. Nor did infection appear to spread readily to mice in adjacent buildings, only 1 of 257 mice from other buildings in the isolation compound being infected. Similarly, 20 wood mice and 3 bank voles were collected from a field used continually for spreading sewage sludge and whilst it is probable that this material would have contained small numbers of salmonellas from time to time, infection was not detected in the wild rodent population. The fact that three serotypes other than *S. dublin* and *S. typhimurium* have been isolated from Compton pigs (Jones & Hall, 1975) and that these three have also been found in slurry without being found in local small wild mammals reinforces the point that infection of the wild population may not be so readily achieved as has been assumed.

The dairy herds at Compton have been free of salmonellas for many years and there has thus been little chance for infection to spread from cattle to the local wild mammal population. In other areas, though, Jones & Matthews (1975) and Jones *et al.* (1976) demonstrated that 11 and 22% respectively of samples of cattle and pig slurry were infected with salmonellas and it is possible that infection of wild mammals could take place under these conditions.

The failure to isolate salmonellas from species other than the house mouse indicates that the wild free-living population does not at present appear in this area to constitute a reservoir for infection of domestic animals. Indeed, a consideration of the habitats utilized by the common small mammals other than the rat and house mouse, might lead to the conclusion that even in areas of endemic salmonellosis the establishment of a small mammal reservoir was unlikely. Wood mice, bank voles and shrews favour environments with a ground cover of broad-leaved plants and a deep litter layer and, with the exception of wood mice breeding in cereal crops, rarely venture far from woodland and hedgerows. Pasture land is thus a zone of non-contact in which the small mammals are less likely to contact either faeces from infected cattle or infected slurry. Conversely, even if the

small mammals constituted a reservoir there would be only a small zone of overlap around woodland perimeters. This degree of isolation is even greater in the case of the short-tailed vole which inhabits mainly upland sheep pasture and grassland which is rarely grazed. This species is rare in the area covered by this study. It should be pointed out, though, that the ranges of hares, rabbits and cattle do overlap and heavily infected cattle might set up wildlife infection and vice versa.

It is interesting that the only wild species to carry *Salmonella* in this survey is the commensal house mouse and even there the infection was cattle to mouse rather than the reverse. From other work (Gibson, 1961) the same would appear to be true for the other commensal, the rat.

We are grateful to Mrs J. Bew, Mrs T. Brownlie, Mr N. Chanter and Mr J. Cook for technical assistance and collection of specimens and to Mr J. Fogerty for preparation of much of the media used.

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