THE FREQUENCY OF SALMONELLAE IN WILD DUCKS

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SALMONELLA infections in wild birds have been described by many workers (Keymer, 1958; Nielsen, 1960; Jennings, 1961; Macdonald, 1965; Faddoul, Fellows and Baird, 1966; Wilson and Macdonald, 1967). Most of the surveys have been limited, however, to the examination of post-mortem material and the isolation rates have varied. In London, Farrant, Phillips and Roger (1964) found salmonellae in 6.15 per cent. of 246 feral pigeons, but Jennings (1961) isolated them from 0.1 per cent. of 734 wild birds and Keymer (1958) from 0.2 per cent. of 460 such birds; these workers examined 1440 specimens in all.

There are few surveys of faecal excretion rates in wild birds. In London, *Salmonella typhimurium* was recovered from 2.25 per cent. of feral pigeon droppings in Trafalgar Square (Cruickshank and Smith, 1949). During 1966 and 1967, gull faeces from some of the Metropolitan Water Board's installations yielded a 17 per cent. isolation rate of nine different serotypes of salmonellae, including seven different phage-types of *S. typhimurium* (Windle Taylor, 1967). These findings differ from those of Farrant *et al.*, whose isolates were all *S. typhimurium* of the characteristic phage-type u40 but without the O5 antigen.

The object of this study was to determine the faecal excretion rate of salmonellae in free-living wild ducks. These birds cross large areas of Europe in their annual migrations from the North to their wintering areas in Britain and elsewhere and are a potential health hazard to man.

MATERIALS AND METHODS

Duck droppings were collected from Barn Elms Reservoir, London, during 1969 and 1970. Most of the specimens were collected in the early morning. Care was taken to obtain fresh specimens from areas where ducks had been observed to have been roosting overnight on the brickwork edge of the reservoir.

The actual number of ducks roosting on the reservoir was between 500 and 1500 in both winters. The three predominant species were tufted duck (*Aythya fuligula*), pochard (*Aythya ferina*) and teal (*Anas crecca*). Smaller numbers of widgeon (*Anas penelope*) and gadwall (*Anas strepera*) were also present.

The faeces were suspended in sterile 0.9 per cent. saline to give an approximate dilution of 1 in 20. Within 2 hr a loopful of the saline suspension was inoculated into Rappaport's medium (Rappaport, Konforti and Navon, 1956) and into Selenite F broth; after 24 hr both of these were subcultured on MacConkey bile salt agar, desoxycholate citrate agar (DCA) and Wilson and Blair's bismuth sulphite agar (Oxoid). This range of media was used partly to compare Selenite F with Rappaport's medium, but also to screen for the presence of *S. typhi* for which Rappaport's medium is not suitable.

Salmonellae were identified by the customary biochemical and serological tests. All positive results were confirmed by the Salmonella Reference Laboratory, P.H.L.S., Colindale. Phage-typing was carried out at the Enteric Reference Laboratory, Colindale.

RESULTS

During two winters (1968/69 and 1969/70), 477 duck droppings found at Barn Elms Reservoir were examined. In the first winter, 307 samples were cultured of which 13 (4.24 per cent.) contained salmonella serotypes; during the second winter 170 samples yielded seven (4.11 per cent.) isolates (table). Most isolations were from the three commonest species

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of duck, pochard, teal and tufted duck. There was little difference in the carrier rate among them; approximately one bird in 25 of these three species excreted salmonellae.

The most frequently isolated serotype was *S. typhimurium* which was found in 18 samples. Seven phage-types of this organism were observed, of which 2a was the commonest. The other serotypes were *S. paratyphi* B (phage-type 3a) and *S. emek*. *S. typhi* was not encountered.

Rappaport's medium was more efficient than Selenite F in isolating salmonellae from duck droppings. Out of a total number of 20 isolations, five were grown in both media; all the others were isolated in Rappaport's medium only.

TABLE
Incidence and types of salmonellae in wild ducks

Species of duck	Number examined during		Number positive for salmonellae	Salmonella isolates	
	1968/69	1969/70		Serotype	Phage-type
Teal	58	30	3	<i>S. typhimurium</i>	u15, 2a (2)
Tufted duck	109	89	10	<i>S. typhimurium</i> <i>S. paratyphi</i> B <i>S. emek</i>	2a (5), u218 (3) 3a —
Pochard	79	51	4	<i>S. typhimurium</i>	2a, u40, u195, u180
Species uncertain	34	0	3	<i>S. typhimurium</i>	u102, u165 (2)
Widgeon	12	0	0	...	...
Gadwall	15	0	0	...	...
Total	307	170	20		

DISCUSSION

The frequency of faecal excretion of salmonellae found in this survey of wild ducks is higher than was expected from the post-mortem studies of previous workers. The results, however, are in accord with the recent findings of Windle Taylor (1967) and Farrant *et al.* (1964) in other species of birds.

Salmonella carriage in birds is usually regarded as transient, but our findings of a frequency of just over 4 per cent. in both winters suggests that a constant proportion of birds harbour salmonellae. The alternative explanation is that constant reinfection takes place during the winter when large numbers of birds flock together.

All the salmonella serotypes isolated are known to cause disease in man; the commonest were *S. typhimurium*, phage-type 2a, and *S. paratyphi* B, phage-type 3a.

The ducks from which these organisms were isolated are winter visitors to this country. They probably summer in Scandinavia and Russia (Spencer, 1966, 1967, 1968), the autumn and spring migrations taking place in easy stages depending on weather conditions and local food supplies. During the winter there is much local movement of birds, and infected birds can, therefore, pollute many tracts of water during the course of a year.

Salmonella excretion into water intended for human use is a very important problem, as shown by a survey for the Metropolitan Water Board (Windle Taylor). The salmonella serotypes recovered from gull faeces overlapped considerably with those found in primary and secondary filtration installations on some reservoirs. It is reasonable to assume that ducks may also contribute to this bacterial contamination.

Our assessment of Rappaport's medium for isolating salmonellae from bird faeces is in accord with the findings of others (Hooper and Jenkins, 1965). The greater recovery rate

of these organisms when this medium is used may partly explain the wide differences in the published rates of avian salmonellosis.

SUMMARY

The faecal excretion rate of salmonellae in migratory wild ducks is higher than previous studies would indicate. Examination of 477 duck droppings during the winters of 1968/69 and 1969/70 gave isolation rates of just over 4 per cent. The commonest serotype was *S. typhimurium*; seven different phage-types were found, 2a being the most frequent.

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