Role of wild birds in the epidemiology of infection in an outdoor pig farm in the United Kingdom.

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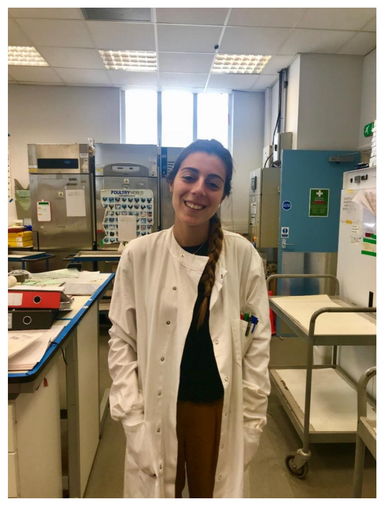

Introduction

In the European Union in 2015, 13% of the strong evidence foodborne outbreaks caused by *Salmonella* were attributable to the consumption of pork and pork products. *Salmonella* contamination of retail pork is directly linked to the *Salmonella* prevalence on farm.
In UK, approximately 40% of breeding pigs are kept outdoors. In outdoor and organic farms, good biosecurity measures are more difficult to apply.
The role of wild birds in the *Salmonella* epidemiology on farm is still unclear, in terms of potential hazard to animals but also for human health.

Aim

To investigate the role of wild birds in the *Salmonella* epidemiology in one outdoor pig farm in United Kingdom

Conclusion

Pigs are the likely source of *Salmonella* infection in wild birds.
Wild birds are likely recycling the infection and contributing to the persistence of *Salmonella* between batches of pigs.

Material and Methods

- Three farms visits, at times determined by pig farm depopulation, were made in a farm consisting of two adjacent fields, one left empty for more than 2 years and one occupied by pigs during the first farm visit only.
- Environmental samples and wild birds dropping samples were collected at each visit. Pig floor faeces were collected at the first visit only.
- *Salmonella* was isolated according to ISO 6579-1:2017.
- Serotypes were determined for a selection of isolates according to the White-Kauffmann-Le Minor scheme. For each farm visit, a selection of representative samples for *S.* Typhimurium and *S.* Typhimurium serovar 4,[5],12:i:- were further characterized by phage typing.
- Quantitative analysis was performed on a random selection of positive samples.

Results

Visit 1

Field	Sample type	Area sampled	No. positives/ No. Tested (%)	Count (CFU/g)	Serotype
Field 1	Individual samples	Bird dropping	1/19 (5.2%)	1-10 (1)	Typhimurium (1)
		Environmental	2/12 (16.6%)	1-10 (2)	4,5,12:i:- (2)
Field 2		Bird dropping	1/8 (12.5%)		
		Environmental	28/43 (65.1%)	1-10 (23) 10 -100 (4)	4,5,12:i:- (16), Rissen(4), Panama (1)
		Weaners	42/60 (70%)	1-10 (7) 10-10^2 (2) 10^2-10^3 (8) 10^3-10^4(3)	4,5,12:i:- (18), Rissen (1)
		Growers	55/60 (91.6%)	1-10 (1) 1-10^2 (6) 10^2-10^3 (7) 10^3-10^4 (3) 10^5-10^6(2)	4,5,12:i:- (17), Rissen (2)
	Pool samples	Weaners	15/18 (83.3%)		4,5,12:i:- (3), Panama (1)
		Growers	17/17 (100%)		4,5,12:i:- (2), Rissen (3)
		Environmental	5/5 (100%)		4,5,12:i:- (3)

During the first farm visit *Salmonella* was isolated from:
- **73.1%** of the weaners' samples (57 of 78) and **93.5%** of the growers' samples (72 of 77).
- **58.3%** (35 of 60) of the environmental samples.
- **7.4%** (2 of 27) of the **wild birds droppings**.

***Salmonella* CFU/gram**
- High levels of *Salmonella* were found in individual pig faecal samples up to (10^5-10^6 CFU/g).
- Low level of *Salmonella* were found in environmental samples (1-10 CFU/g or 10-10^2 CFU/g) and in the 2 of the positive wild bird droppings (1-10 CFU/g).

Visit 2

Field	Sample type	Area sampled	No. positives/ No. Tested (%)	Count (CFU/g)	Serotype
Field 1	Individual samples	Bird dropping	7/57 (12.2%)	1-10 (3) 10-10^2 (1) 10^3-10^4 (1) 10^4-10^5 (1) 10^5-10^6 (1)	4,5,12:i:- (3),Senftenberg (3), Typhimurium (1)
		Environmental	3/54 (5.5%)	1-10 (3)	4,5,12:i:- (3)
	Pool samples	Environmental	8/33 (24.2%)		Rissen (3)
Field 2	Individual samples	Bird dropping	0/12 (0%)		
		Environmental	25/47 (53.1%)	1-10 (11) 10-10^2 (1)	4,5,12:i:- (2), Rissen (3)
	Pool samples	Bird dropping	5/7 (71.4%)		4,5,12:i:- (2)

During the second farm visit, *Salmonella* was isolated from:
- **26.9%** (36 of 134) of environmental samples.
- **15.8%** (12 of 76) of **wild birds droppings**.

***Salmonella* CFU/gram**
- Low level of *Salmonella* was found in environmental samples (1-10 CFU/g or 10-10^2 CFU/g)
- Unusually high *Salmonella* levels was found in bird dropping (up to 10^5-10^6 CFU/g).

Visit 3

Field	Sample type	Area sampled	No. positives/ No. Tested (%)	Count (CFU/g)	Serotype
Field 1	Individual samples	Bird dropping	3/46 (6.5%)	1-10 (1) 10-10^2 (1) 10^3-10^4 (1)	4,5,12:i:- (1),Rissen (2),
		Environmental	3/63 (4.7%)	10-10^2 (1)	4,5,12:i:- (3),
	Pool samples	Environmental	5/32 (15.6%)		
Field 2	Individual samples	Bird dropping	24/25 (96%)	1-10 (3) 10-10^2 (6) 10^2-10^3 (8) 10^3-10^4 (4) 10^5-10^6 (2)	4,5,12:i:- (23),
		Environmental	28/35 (80%)	1-10 (17) 10-10^2 (8) 10^2-10^3(3)	4,5,12:i:- (23),Rissen (3), Derby (1),
	Pool samples	Bird dropping	8/8 (100%)		Rissen (1)

During the third farm visit *Salmonella* was isolated from:
- **27.7%** (36 of 130) of environmental samples
- **44.3%** (35 of 79) of **wild bird droppings**.

***Salmonella* CFU/gram**
- Low level of *Salmonella* was found in environmental samples (1-10 CFU/g up to 10^2-10^3 CFU/g).
- Unusually high *Salmonella* levels was found in bird droppings up to (10^5-10^6 CFU/g).

the proportion of *Salmonella* -positive wild bird faeces increased overtime

Discussion

Interestingly, the proportion of *Salmonella*-positive wild bird droppings increased over time by 7.4%, 24.6% and 44.3% at the first, second and third visit, respectively. The levels of *Salmonella* identified in some of the wild bird droppings were unusually high (10^5- 10^6 CFU/g) suggesting that *Salmonella* was actively replicating in the gastrointestinal tract of these birds.
Monophasic *Salmonella* Typhimurium was the predominant *Salmonella* isolated, even in wild bird droppings, supporting the hypothesis that the pigs were likely to be the original source of infection, as this serovar is typically associated with pig production and is not normally found in wild birds that are not exposed to other infected species.
The pig farm sampled in this study is adjacent to a water course and a wild bird reserve. This could have impacted on the epidemiology of infection and persistence of *Salmonella*. Further farms should be sampled to gather more evidence on the role of wild birds in outdoor pig production.

Serotypes