

Phage types and prevalence of *spvC* in *Salmonella* Typhimurium isolates from domestic and wild animals in Finland in 2007-2013

Henry Kuronen¹, Aino Kyyhkynen², Sirpa Heinikainen¹, Tarja Pohjanvirta¹, Sinikka Pelkonen¹

¹Evira, Finnish Food Safety Authority, Veterinary Bacteriology Research Unit

²THL, National Institute for Health and Welfare, Bacterial Infections Unit

Introduction

- *Salmonella* Typhimurium phage type DT1 has been endemic to Finland for decades.
 - We have previously reported that the major genotypes of endemic Typhimurium DT1 during 1972–1999 did not possess *spvC* gene of the salmonella serovar specific plasmid (4).
- Typhimurium isolates have ever since been routinely tested for *spvC* in the epidemiological surveillance.
- Here we report the results for phage types and prevalence of *spvC* in Typhimurium isolates from animals in Finland during 2007–2013.

Material and methods

- All the salmonella isolates from animals in Finland during 2007–2013 were confirmed and serotyped in the Finnish Food Safety Authority Evira.
- Altogether 157 Typhimurium isolates from food-producing and pet animals and 215 Typhimurium isolates from wild animals were phagetyped in the National Institute for Health and Welfare (THL) and tested by PCR for *spvC* (2) in Evira.
- The isolates from food-producing animals were selected for phage typing and testing for *spvC* by the following rules: one isolate per cattle or swine herd per year and one isolate per poultry flock.

Results

- Among the 157 isolates from food-producing and pet animals there were 13 phage types of which the top 6 types (DT 1, 40, 41, 104, RDNC and U277) covered 85%.
- Among the 215 isolates from wild animals there were 11 phage types of which the top 5 phage types (DT 1, 40, 41, RDNC and U277) covered 88%.
- Of the 304 isolates tested for *spvC*, 51.3% were positive (Table 1).
- The possession of *spvC* varied from 3.6 to 100% between the phage types (Table 1).
 - All DT 104 and DT 195 isolates had *spvC*.
 - The phage types commonly associated with small birds mostly lacked *spvC* (DT U277: 0%, DT 40: 3.6%).
 - 98.3% of DT 41 isolates typically associated with seagulls had *spvC*.
 - Half of DT1 isolates possessed *spvC*, while *spvC* negative and positive DT1 isolates were equally distributed in various animal sources.

Table 1. *spvC* positive *S. Typhimurium* strains in animals 2007–2013 in Finland

Phagetype	Strains	<i>spvC</i> Positive	<i>spvC</i> % positive
DT 104	14	14	100
DT 195	13	13	100
DT 2	6	6	100
DT 135	5	5	100
DT 12	2	2	100
DT 35	2	2	100
DT 104b	2	2	100
DT 9 var.	1	1	100
DT 126	1	1	100
DT U302	1	1	100
DT 41	60	59	98,3
DT 120	11	10	90,9
DT 1	37	19	51,4
DT 40	28	1	3,6
DT U277	68	0	0
DT 110	1	0	0
DT 193	1	0	0
DT RDNC	47	19	40,4
DT NT	4	1	25
Total	304	156	51,3

Discussion

- *spvC* seems to be associated with certain phage types of Typhimurium.
- A similar distribution of phage types in wild and domestic animals strongly suggests that these animals and environment make a common pool for Typhimurium as reported earlier (3).
- The percentage of *spvC* positive Typhimurium isolates was lower than published for French isolates (80-90%) (1).
- The observed low level of *spvC* among the Finnish Typhimurium isolates results from the relative common occurrence of phage types DT1, 40 and U277 that often or completely lack *spvC*.

1. Bugarel M., Granier S.A., Weill F.-X., Fach P., Brisabois A., 2011, A multiplex real-time PCR assay targeting virulence and resistance genes in *Salmonella enterica* serotype Typhimurium BMC Microbiol. 11:151.

2. Chiu C., Ou J.T., 1996, Rapid identification of *Salmonella* serovars in feces by specific detection of virulence genes, *invA* and *spvC*, by an enrichment broth culture-multiplex PCR combination assay. Journal of Clinical Microbiology. 34:2619-2622

3. Horton R.A., Wu G., Speed K., Kidd S., Davies R., Coldham N.G., Duff J.P., 2013, Wild birds carry similar *Salmonella enterica* serovar Typhimurium strains to those found in domestic animals and livestock. Res. Vet. Sci. 95:45-48.

4. Lindqvist N., Heinikainen S., Siitonen A., Pelkonen S., 2004, Molecular characterization of *Salmonella enterica* subsp. *enterica* serovar Typhimurium DT1 isolates. Epidemiol. Infect. 132:263-272.