Distribution of the different capsular types of *Streptococcus suis* in nineteen swine nurseries

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Streptococcus suis serotype 2 is the capsular type most frequently isolated from diseased pigs, followed, in decreasing order, by capsular types 3, 1/2, 8, and 4 (1). The prevalence of *S. suis* capsular type 2 in clinically healthy animals varies from 0% to 90% among herds (2). In Canada, capsular type 2 was shown to be present in the upper respiratory tract of 2% to 4% of four to eight-week-old clinically healthy piglets (3,4) and of 7% of pigs at slaughter (5). In clinically healthy pigs, capsular types 17, 18, 19, and 21 represented the majority of *S. suis* isolates (6). Since new capsular types have been described recently (7), the prevalence of each of the 29 capsular types of *S. suis* in clinically healthy pigs has not yet been established. The aim of the present study was to determine the prevalence of all presently known capsular types in weaned piglets.

A total of 958 four to eight-week-old piglets was sampled from 19 nurseries that provided feeder pigs for eight different finishing operations owned by the same industrial organization. The mean inventory in these nurseries was 240 piglets, and an average of 50 animals was randomly selected in each of the herds. At the time of collecting the specimens, all farrowing units and nurseries were free of clinical signs, and had not experienced any disease problem associated with *S. suis* in the previous six months.

Nasal swabs were preferred to tonsilar swabs for practical reasons. Animals were restrained in a seated position. One external naris was cleaned with a sterile gauze soaked in alcohol and samples were collected with a sterile swab (Culturette, Ingram and Bell Scientific, Ville St-Laurent, Québec) twisted at a depth of 8 to 10 cm (4). Swabs were held at 4°C, and laboratory procedures were undertaken the same day.

Blood agar plates (5% bovine blood) containing the selective supplement SR-126 (Oxoid Canada, Nepean, Ontario) were used for the culture of swabs and were incubated at 37°C for 24 h. Depending on the number of different types of colonies, a maximum of six alpha-hemolytic colonies were selected from each plate. Each colony was streaked onto a blood agar plate for subculture. After 24 h of incubation at 37°C, cultures were processed and held at −70°C until the time of identification.

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Isolates were then cultured in Todd-Hewitt broth and only capsulated isolates were studied further (8,9). Serotyping was done using the 28 antisera produced against the reference strains of the capsular types of *S. suis*. Capsular type 1/2 was identified by a positive reaction with antisera to capsular types 1 and 2. Isolates were screened by the coagglutination test (8), with the use of five polyvalent antisera (pools): pool 1 (capsular types 1–4, 8, 22), pool 2 (capsular types 17–19, 21, 23, 24), pool 3 (capsular types 5–7, 9, 16, 20), pool 4 (capsular types 10–15), and pool 5 (capsular types 25–28). The production of antisera was carried out as described previously (9), and the pools were produced according to a standardized procedure developed in our laboratory. A positive reaction to one pool by an isolate was followed by the application of the coagglutination test with each of the antisera present in that pool. In each case, the capsular type was confirmed with the capsular reaction test (9). Isolates that did not belong to any of the 29 capsular types were submitted to the following tests: growth in 6.5% NaCl, Voges-Proskauer (VP), and amylase (7,9).

A total of 3157 alpha-hemolytic colonies was collected from the 958 swabs. Eight isolates were nonviable, and so the study was carried out on 3149 isolates. A total of 2184 (69%) isolates was identified as *S. suis* based on their serological or biochemical properties. Of that, 1879 (86%) isolates belonged to one of the 29 capsular types of *S. suis* already described. The remaining 305 isolates (14%) were biochemically similar to *S. suis*, but were untypable with the 28 antisera used. Almost 31% of the isolates (965) were not classified as *S. suis*, as they did not react with any of the antisera and were biochemically incompatible with this species. Most of them were VP positive, which ruled out the possibility of *S. suis*. *Streptococcus suis* was found in all 19 herds and isolated from 75% of the animals. Thirty-one percent of the piglets had only one capsular type of *S. suis*, 38% had two or three capsular types, and 6% had more than four capsular types in their nasal cavities.

The distribution of piglets according to the *S. suis* capsular types isolated and their herd of origin is shown in Table 1. Four capsular types, 10, 11, 20 and 24, were not detected in any of the pigs. The six most prevalent capsular types in piglets were, in decreasing order, 19 (24%), 21 (19%), 7 (18%), 3 (15%), 8 (14%), and 28 (10%). These six capsular types accounted for 69% of all the typable isolates. They, along with capsular type 12, were present in almost 90% of the herds. Capsular types 17, 18, 19 and 21 represented almost 40% of all typable isolates. This high prevalence is consistent with a previous report from clinically healthy piglets in which 87% of *S. suis* isolates that had been untypable with capsular types 1 through 8 antisera could subsequently be grouped within those four capsular types (6).

Although present in eight of the 19 herds, capsular

Table 1. Distribution of carrier pigs according to the capsular type of *Streptococcus suis* isolated and the herd of origin

Herd	Pigs sampled	Capsular types of *Streptococcus suis*[a]																								Pigs positive[b]
		1	1/2	2	3	4	5	6	7	8	9	12	13	14	15	16	17	18	19	21	22	23	25	26	27	28	
1	51	0	6	1	3	2	0	0	16	8	0	3	0	0	1	1	5	3	16	8	1	0	2	0	2	2	42
2	48	1	7	2	6	7	1	0	5	5	1	1	0	0	2	0	3	1	8	7	0	0	0	0	1	5	36
3	50	1	14	1	10	6	1	1	16	8	2	1	0	0	0	1	8	2	14	15	0	0	2	0	0	2	48
4	50	0	4	6	10	4	0	0	9	5	2	3	0	0	1	0	13	12	18	17	0	0	1	1	0	4	49
5	50	1	3	0	27	2	1	0	25	12	4	1	1	0	0	2	7	2	27	11	1	0	0	0	1	8	42
6	50	0	1	0	1	0	0	0	1	1	0	2	0	0	0	0	1	0	1	0	0	0	0	1	0	1	4
7	50	4	4	1	20	2	0	1	22	12	2	6	0	0	0	3	3	2	16	2	0	0	0	0	0	10	47
8	50	1	1	1	5	2	1	0	9	17	1	1	0	0	13	0	1	3	3	2	2	0	0	0	0	2	40
9	49	0	1	1	13	1	1	0	15	10	2	0	0	0	0	5	2	3	3	2	1	0	0	0	0	1	32
10	53	1	2	0	14	3	1	1	11	11	1	2	0	0	1	1	2	1	6	3	0	0	1	0	0	1	38
11	51	0	2	0	8	7	1	1	12	7	1	1	0	0	2	0	0	1	14	19	2	0	1	0	0	18	46
12	51	0	1	0	5	6	1	0	7	8	0	1	2	0	1	1	0	2	22	17	0	1	2	0	0	14	49
13	51	0	0	0	3	2	0	0	9	5	0	2	0	0	1	2	0	1	15	7	2	0	0	1	0	15	41
14	51	2	0	0	7	8	0	0	7	5	0	1	0	0	1	0	0	0	22	17	3	1	0	0	0	12	46
15	50	0	10	0	0	2	0	0	8	4	10	2	0	0	3	0	0	0	3	17	0	0	0	0	0	2	34
16	50	0	4	1	1	1	0	0	1	8	6	3	0	0	0	2	0	0	2	4	0	0	1	1	1	0	29
17	50	0	6	0	6	3	0	0	3	9	3	0	2	1	0	0	0	0	19	5	0	0	0	0	3	0	40
18	53	1	1	0	1	0	2	0	1	0	0	1	2	0	0	0	1	0	9	6	0	0	0	1	2	2	23
19	50	1	0	0	0	0	0	0	0	4	0	1	0	0	1	0	0	1	15	19	1	1	0	0	0	1	32
Total:	958	13	67	14	140	58	10	4	177	139	35	32	7	1	27	18	46	34	233	178	13	2	10	5	10	100	718
% of pigs		1.4	7.0	1.5	14.6	6.1	1.0	0.4	18.5	14.5	3.7	3.3	0.7	0.1	2.8	1.9	4.8	3.5	24.3	18.6	1.4	0.2	1.0	0.5	1.0	10.4	74.9
% of herds		47	84	42	89	84	47	21	95	95	63	89	21	5	58	47	58	68	100	95	42	11	37	26	32	89	100
% of isolates[c]		1.4	4.9	1,5	9.5	4.2	0.5	0.3	12.2	9.6	1.6	1.9	0.3	0.1	1.6	1.2	4.6	4.6	17.9	12.2	0.7	0.5	0.9	0.2	0.5	7.2	—

[a]Capsular types 10, 11, 20 and 24 were not detected in any of the pigs
[b]Total number of pigs from which at least one typable strain of *S. suis* was isolated
[c]Total number of typable isolates of *S. suis* was 1879

type 2 was isolated from only 1.5% of piglets. The number of positive pigs per herd was very low with the exception of one herd in which six pigs were positive for serotype 2. This is in accordance with our previous reports (3,4), and with a British study (2) that demonstrated that in four farms without any history of clinical signs, two were negative for the presence of capsular type 2, one had a prevalence of 1.5%, and another a prevalence of 20%. It is suggested that in clinically healthy pigs capsular types normally present in the nasal flora could compete against more virulent and possibly transitory capsular types.

Polyvalent antisera were very useful for the identification and determination of the capsular type of *S. suis* isolates. Other immunological techniques, such as the indirect fluorescent antibody test, have been used by other authors to simultaneously identify this bacterium along with its capsular type (10); however, the number of isolates and capsular types was much lower than in the present work. In this study, the screening method using pools of antisera with the coagglutination method was rapid and allowed the analysis of a large number of isolates in a short period of time. A biochemical identification system must be applied to isolates which do no react with any of the antisera to confirm their identity as *S. suis*. In our study, about 30% of alpha-hemolytic streptococci from nasal cavities were biochemically incompatible with *S. suis*. These results are similar to those reported in a previous study carried out with alpha-hemolytic streptococci isolated from different tissues from diseased pigs in which 23% of isolates were identified as *S. bovis*, *Aerococcus* spp., or others (11).

Only 14% of *S. suis* isolates did not belong to any of the 29 capsular types. This is a major decrease in the number of untypable isolates in comparison to an earlier study in which 79% of *S. suis* isolates recovered from clinically healthy piglets could not be included in the nine capsular types known at that time (3). This difference is likely attributable to the use of a more complete serotyping system, since 48% of *S. suis* isolates in our study belonged to one of the 20 capsular types described in recent years (7,8). CVJ

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