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Abstract

Between October 2007 and March 2008, 153 wild boars shot in the Canton of Geneva in Switzerland were sampled. 51% of the animals were males and 49% were females. The weight of most (81%) animals varied between 20 and 60 kg. Prevalence of enteropathogenic Yersinia was studied from tonsils and faeces using cultural and molecular based methods and from tonsil fluid using an ELISA system. Prevalence of anti-Yersinia antibodies in tonsil fluid was 65%. Detection rate of enteropathogenic Yersinia in tonsils of 153 wild boars by real-time PCR was 44%. ail-positive Y. enterocolitica and inv-positive Y. pseudotuberculosis were detected by PCR in 35 and 20% of the animals, respectively. Both species were detected in 10% of the animals. Isolation rate of enteropathogenic Yersinia was low; ail-positive Y. enterocolitica and inv-positive Y. pseudotuberculosis were found in 9 and 3% of the animals, respectively. Prevalence was shown to be clearly higher in tonsils compared to faeces. Furthermore, females were more commonly positive than males. This study shows that the prevalence of enteropathogenic Yersinia is high and both enteropathogenic Y. enterocolitica and Y. pseudotuberculosis are common findings in tonsils of wild boars in Switzerland. Although the prevalence of ail-positive Y. enterocolitica was shown to be clearly lower in wild boars compared to fattening pigs.
Prevalence of pathogenic *Yersinia enterocolitica* and *Yersinia pseudotuberculosis* in wild boars in Switzerland

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Abstract

Between October 2007 and March 2008, 153 wild boars shot in the Canton of Geneva in Switzerland were sampled. 51% of the animals were males and 49% were females. The weight of most (81%) animals varied between 20 and 60 kg. Prevalence of enteropathogenic *Yersinia* was studied from tonsils and faeces using cultural and molecular based methods and from tonsil fluid using an ELISA system. Prevalence of anti-*Yersinia* antibodies in tonsil fluid was 65%. Detection rate of enteropathogenic *Yersinia* in tonsils of 153 wild boars by real-time PCR was 44%. *ail*-positive *Y. enterocolitica* and *inv*-positive *Y. pseudotuberculosis* were detected by PCR in 35 and 20% of the animals, respectively. Both species were detected in 10% of the animals. Isolation rate of enteropathogenic *Yersinia* was low; *ail*-positive *Y. enterocolitica* and *inv*-positive *Y. pseudotuberculosis* were found in 9 and 3% of the animals, respectively. Prevalence was shown to be clearly higher in tonsils compared to faeces. Furthermore, females were more commonly positive than males. This study shows that the prevalence of enteropathogenic *Yersinia* is high and both enteropathogenic *Y. enterocolitica* and *Y. pseudotuberculosis* are common findings in tonsils of wild boars in Switzerland. Although the prevalence of *ail*-positive *Y. enterocolitica* was shown to be clearly lower in wild boars compared to fattening pigs.

**Keywords:** *Yersinia enterocolitica; Yersinia pseudotuberculosis*; wild boar; ELISA; PCR; isolation
1. Introduction

Yersiniosis is a disease that affects wild and domestic animals as well as humans. Enteric Yersiniosis is caused by pathogenic *Yersinia enterocolitica* and *Y. pseudotuberculosis*. However, human yersiniosis, which is very common in Europe, is mostly caused by *Y. enterocolitica* (EFSA 2007). The disease is transmitted by the faecal-oral route and typical symptoms are fever, abdominal pain and diarrhoea, most commonly in young children (Bottone 1997; Jalava et al. 2006). Acute Yersiniosis in animals, which is more frequently caused by *Y. pseudotuberculosis*, is characterised as enteritis and enlargement of lymph nodes and spleen whereas chronic infections may cause granulomatous nodules and localised abscesses affecting various organs, typically liver and lungs (Brügmann et al. 2001; Zhang et al. 2008).

*Y. enterocolitica* and *Y. pseudotuberculosis* have been recovered from diverse animal sources ranging from farm animals and domestic pets to free-living and captive wild animals (Fukushima and Gomyoda 1991; Bottone 1997). However, human pathogenic strains of *Y. enterocolitica* have frequently been isolated only from asymptomatic pigs at slaughter (Fredriksson-Ahomaa et al. 2006). In Switzerland, the prevalence of pathogenic *Y. enterocolitica* has shown to be high in the tonsils of pigs at slaughter: 85 and 34% with PCR and culturing, respectively (Fredriksson-Ahomaa et al. 2007). *Y. pseudotuberculosis* has also sporadically been isolated from tonsils of slaughter pigs (Niskanen et al. 2002; Ortiz Martinez et al. 2009).

In the past years, the wild boar population has increased considerable in Europe including Switzerland (Köppel et al. 2007). In the same time also out-door farming of domestic pigs has getting more popular, which may raise the risk of contact between wild boars and domestic pigs and in this way also raise the risk of transmission of pathogenic *Yersinia* between the animals. Until today, very little information is available about wild
boars as carriers of this pathogen. Thus, the goal of this study was to provide data on the prevalence of enteropathogenic *Yersinia*, including both pathogenic *Y. enterocolitica* and *Y. pseudotuberculosis* in male and female wild boars of different weights using different detection methods.

2. Materials and methods

2.1. Sampling and sample preparation

In total, 153 wild boars shot in the Canton of Geneva in Switzerland were studied. Of 151 animals with known gender, 49% (73) were females and 51% (78) were males (Table 1). The weight of most animals (120/148) varied between 20 and 60 kg (Table 2). Tonsil and faeces samples were collected between October 2007 and March 2008 and placed in sterile plastic bags, which were stored at -20°C until examination. Of 146 animals both tonsils were studied and from seven animals only one tonsil was available for testing. Faecal samples were obtained from 73 animals. In total 299 tonsil and 73 faecal samples were studied. One tonsil and about 1-g faeces sample was homogenised in 90 ml of tryptic soy broth (CASO, Merck, Darmstadt, Germany). About 100-500 µl tissue fluid of tonsils of 153 wild boars were collected and stored at -20°C until further examination by ELISA.

2.2. Detection of *ail*-positive *Yersinia enterocolitica* and *inv*-positive *Yersinia pseudotuberculosis* using real-time PCR and culture methods

Real-time PCR was used to detect *ail*-positive *Y. enterocolitica* and *inv*-positive *Y. pseudotuberculosis* directly from the overnight enrichment (25°C, 16-18 h) in CASO bouillon. The DNA was extracted using InstaGene (BioRad, Hercules, CA) based on the chelating properties of Chelex resin. A real-time PCR protocol based on SYBRGreen was used for both pathogens according to Fredriksson-Ahomaa et al. (2007). Briefly, 2 µl of the
template was added to 23 µl of the master mix, which contained 1x ready-to-use mix (iQ™SYBRGreen Supermix, BioRad) and 200 nM of primers. A 3-step protocol (denaturation at 95°C for 10 s, annealing at 56°C for 20 s and elongation at 72°C for 10 s) with 40 cycles followed by melting curve analysis was performed. A 170 bp-fragment of *ail* gene according to Nakajima et al. (1992) and a 183 bp-fragment of *inv* gene according to Thoerner et al. (2003) from *Y. enterocolitica* and *Y. pseudotuberculosis*, respectively, were amplified. The PCR fluorescence was detected using the iQ™5 Multicolour Real-Time PCR Detection System (BioRad). A threshold cycle (Ct) under 38 and a defined melting curve indicated a positive result.

*Y. enterocolitica* and *Y. pseudotuberculosis* were isolated using direct plating, non-selective and selective enrichment. Direct plating was done on a selective CIN (cefsulodin-irgasan-novobiosin) agar plate (Merck) after homogenisation. For non-selective enrichment, the samples were incubated in CASO bouillon (Merck) at 25°C for 16-18 h and then plated onto CIN agar plates. For selective enrichment, one ml of the homogenate was transferred into 9 ml of irgasan-ticarcillin-potassium chlorate (ITC bouillon) (Merck), incubated at 25°C for 2 d and streaked onto a CIN agar plate. CIN agar plates were incubated at 30°C for 18-20 h and further 24 h at room temperature. Urease-positive isolates were identified using API 20E. The chromosomal encoded *ail* and *inv* genes of *Y. enterocolitica* and *Y. pseudotuberculosis*, respectively, were confirmed by real-time PCR. The *ail*-positive *Y. enterocolitica* isolates were bio- and serotyped (Fredriksson-Ahomaa et al. 2007). The biotype of *Y. enterocolitica* was determined using pyrazinamidase and tween activity, esculin hydrolysis, indole production, and salicin, xylose and trehalose fermentation tests (Wauters et al. 1987). *Y. pseudotuberculosis* was biotyped using raffinose and melibiose fermentation, and citrate utilisation tests (Tsubokura and Aleksic 1995). Serotyping was performed with the
slide agglutination using commercial *Y. enterocolitica* O:3, O:5, O:9 and O:27 antisera (Sifin, Berlin, Germany) and *Y. pseudotuberculosis* O:1 to O:4 antisera (MastGroup, Bootle, UK).

### 2.3. *Yersinia* ELISA

Anti-*Yersinia* antibodies were determined in tonsil juice of 153 animals using a microtitre plate based enzyme immunoassay (PIGTYPE® YOPSCREEN, Labor Diagnostic, Leipzig, Germany) according to manufacturer’s instructions. The antigens used in the test are *Yersinia* Outer Proteins (Yops), which are expressed only by pathogenic *Yersinia* strains. This ELISA kit is suitable for quantification of *Yersinia* antibodies in meat juice samples. The optical density (OD) was measured in a spectrophotometer (680 Microplate Reader, BioRad) and OD values of 0.20 and 0.40 were used as cut-off values.

### 3. Results

The prevalence of enteropathogenic *Yersinia* in the tonsils of wild boars was 44% and 11% using real-time PCR and culture methods, respectively (Table 1). The prevalence of anti-*Yersinia* antibodies was 47 and 65% using OD values over 0.40 and 0.20, respectively.

Pathogenic *Y. enterocolitica* was detected in 35% and *Y. pseudotuberculosis* in 20% of the animals. Fifteen wild boars (10%) were carrying both species.

Pathogenic *Y. enterocolitica* strains were isolated from 9% and *Y. pseudotuberculosis* from 3% of the animals. Both species were isolated from one animal. The bioserotypes 2/O:5,27, 2/O:9 and 4/O:3 were identified in *Y. enterocolitica* strains isolated from 3, 4 and 5 animals, respectively. Two strains of biotype 2 were not typeable with commercial antisera.

Most (3/4) of the *Y. pseudotuberculosis* strains belonged to serotype O:1.

The prevalence of enteropathogenic *Yersinia* was higher in females than in males with all three methods (Table 1). The prevalence of anti-*Yersinia* antibodies in wild boars was
increasing when the animals were getting older but, using PCR and culture methods, the
prevalence of enteropathogenic *Yersinia* was highest among young animals (<20 kg) and
lowest among older animals (>60 kg) (Table 2).

From 146 wild boars, both tonsils were available for prevalence studies. The overall
animal prevalence is clearly lower if only one tonsil per animal is studied. Most (36/66) of the
animals carried the enteropathogenic *Yersinia* only in one tonsil. Only in 33% (17/52) of *Y.
enterocolitica*-positive animals, this pathogen was detected in both tonsils. *Y.
pseudotuberculosis* was detected in both tonsils in only 24% (7/29) of *Y. pseudotuberculosis-
positive animals (Table 3). In 6 animals, both *Y. enterocolitica* and *Y. pseudotuberculosis*
were detected but from different tonsil.

Both tonsil and faecal samples were obtained from 73 wild boars. The prevalence of
both enteropathogenic *Yersinia* species was clearly higher in the tonsils compared to faecal
samples with PCR and culturing (Table 4). *Y. pseudotuberculosis* was only detected in tonsil
samples.

4. Discussion

This study shows that wild boars are an important reservoir for enteropathogenic
*Yersinia*. The prevalence of anti-*Yersinia* antibodies was high (65%) when the recommended
cut-off level of 0.20 was used (Table 1). Al Dahouk et al. (2005) have reported a slightly
lower prevalence (63%) of anti-*Yersinia* antibodies in wild boars from North-Eastern
Germany with a Western blot assay.

Pathogenic *Y. enterocolitica* and *Y. pseudotuberculosis* were common findings in tonsils
of Swiss wild boars using PCR showing that these animals are an important reservoir for both
enteropathogenic *Yersinia* species. Enteropathogenic *Yersinia* has previously only
sporadically been isolated from wild boars (Nikolova et al. 2001, Hayashidani et al. 2002).
Nikolova et al. (2001) isolated *Y. enterocolitica* O:3 from a liver sample and *Y. pseudotuberculosis* O:2 from heart, spleen and kidney samples in Hungary. In Japan, *Y. enterocolitica* O:4 was isolated from 5 (4%) out of 131 wild boars when faecal samples were studied but no pathogenic *Y. enterocolitica* was found (Hayashidani et al. 2002). In this study, *ail*-positive *Y. enterocolitica* strains were isolated from tonsils of 14 (9%) animals and the strains belonged to bioserotypes 2/O:5,27, 2/O:9 and 4/O:3. *Y. pseudotuberculosis* strains were isolated from 4 (3%) tonsils and the dominant serotype was O:1.

Pathogenic *Y. enterocolitica* (35%) was more frequently detected than *Y. pseudotuberculosis* (20%). Though, the PCR prevalence of *Y. pseudotuberculosis* in wild boars (20%) was surprisingly high. It was clearly higher than in domestic pigs (10%) in Switzerland (unpublished data). One explanation could be that wild boars have more frequent contact with wild animals, which have been shown to be an important reservoir of *Y. pseudotuberculosis* (Fukushima and Gomyoda 1991). Laukkanen et al. (2008) have demonstrated that the prevalence of *Y. pseudotuberculosis* in domestic pigs was higher in organic production than in conventional production, and that contact with pest animals and the outside environment increases the prevalence.

The prevalence of pathogenic *Y. enterocolitica* was clearly lower in wild boars (34%) compared to domestic pigs (88%) in Switzerland (Fredriksson-Ahoma et al. 2007). One reason could be that domestic pigs are bred and raised in intensive conditions where transmission of *Y. enterocolitica* from positive animals to negative animals is unavoidable. It has been shown that a specialised fattening pig production system with intensive raising conditions have the highest prevalence for *Y. enterocolitica* in pigs (Skjerve et al. 1998). The prevalence of enteropathogenic *Yersinia* was lower by culture methods (11%) compared to PCR (44%). The low sensitivity of culture methods was also shown when tonsils of domestic pigs were studied: *ail*-positive *Y. enterocolitica* was detected in 88% of the pigs.
with real-time PCR but only in 34% by culturing (Fredriksson-Ahomaa et al. 2007). The isolation of *Y. pseudotuberculosis* from naturally contaminated samples has been shown to be very difficult due to the fact that this pathogen is growing very slowly. The minute colonies are very easily overgrown with other bacteria (Niskanen et al. 2002, 2008, Laukkanen et al. 2008, Ortiz Martínez et al. 2009). This could also explain the very low isolation rate of *Y. pseudotuberculosis* (3%) in the present study. Furthermore, no selective agar plate is available for isolation of *Y. pseudotuberculosis*. CIN agar designed for *Y. enterocolitica*, which is the most frequently used agar plate also for *Y. pseudotuberculosis* and was used in the present study, may inhibit some strains of *Y. pseudotuberculosis* (Fukushima and Gomyoda 1986).

The prevalence of enteropathogenic *Yersinia* was clearly higher among females than males with all three methods. An explanation for this result could be the fact that female wild boars are living close together in groups cross-infecting each other. Males are mostly living alone and have less contact with other wild boars. A previous study, however, found no clear difference between the genders of wild boars in Germany (Al Dahouk et al. 2005).

Enteropathogenic *Yersinia* were detected more frequently among young wild boars than among older ones, which shows that especially young animals are important carriers of pathogenic *Y. enterocolitica* and *Y. pseudotuberculosis*. Hayashidani et al. (2002) isolated *Y. pseudotuberculosis* only from wild boars which are younger than 2 years. It has been shown that the prevalence of enteropathogenic *Yersinia* is significantly higher in tonsils among young pigs (about 6 months old) than among sows at slaughter (Niskanen et al. 2002, 2008, Korte et al. 2004, Gürtler et al. 2005). An explanation for the lower prevalence among older animals may be acquired immunity. In this study, we have shown that the anti-*Yersinia* antibodies increased when the animals were getting older. Al Dahouk et al. (2005) reported also a significant increase of anti-*Yersinia* antibodies in wild boars in Germany. Nesbakken et al. (2006) have demonstrated that antibodies against *Y. enterocolitica* increased in domestic
pigs first after the animals were about 3 months old but they become carriers in faeces and
tonsils before the antibodies increase.

Enteropathogenic *Yersinia* were detected in both tonsils of only 48% of the animals and
in some of the animals *Y. enterocolitica* was detected in one tonsil and *Y. pseudotuberculosis*
in the other one. These results show that both tonsils should be studied when the prevalence
of enteropathogenic *Yersinia* in tonsils are determined. The prevalence would be
underestimated if only one tonsil is studied.

The prevalence of enteropathogenic *Yersinia* was higher in tonsils compared to faecal
samples using both PCR and culture methods. It has already been shown that
enteropathogenic *Yersinia*, especially *Y. enterocolitica*, can more efficiently be isolated from
tonsils than from faeces of pigs at slaughter (Gürtler et al. 2005, Nesbakken et al. 2006,
Bucher et al. 2008, Laukkanen et al. 2008). An explanation could be that enteropathogenic
*Yersinia* bacteria are excreted in the faeces in large quantity only in the acute phase but a vast
amount of bacteria are able to survive in the lymphatic tissue for a longer time. In the study
from Laukkanen et al. (2008), the difference between the prevalence of *Y. pseudotuberculosis*
in tonsils (10%) and faeces (7%) samples was smaller than in our study. The reason could be
the cold enrichment used by Laukkanen et al. (2008), which may be more effective for
isolation of *Y. pseudotuberculosis* from animals excreting low amount of bacteria in faeces.

The bioserotypes of *Y. enterocolitica* and *Y. pseudotuberculosis* strains isolated from
wild boars were all belonging to types associated with human yersiniosis. Bucher et al. (2008)
have reported a high contamination rate of pathogenic *Y. enterocolitica* (38%) in game meat
including wild boar meat. Pathogenic *Y. enterocolitica* was detected in 36% (5/14) of wild
boar meat (unpublished). In the present study, it has been shown that wild boars are an
important reservoir of enteropathogenic *Yersinia* and, thus, may be the primary contamination
source of wild boar meat. The slaughter hygiene is crucial due to the high prevalence of
enteropathogenic *Yersinia* in wild boar tonsils. The tonsils should be removed so that a cross-
contamination to other parts of the carcass and offal and to other carcasses is as low as
possible.
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Table 1. Prevalence of enteropathogenic *Yersinia* in the 153 wild boars shot in Switzerland

<table>
<thead>
<tr>
<th>Species</th>
<th>Sex</th>
<th>Number of positive animals</th>
<th>PCR (%)</th>
<th>Culture (%)</th>
<th>ELISA&lt;sup&gt;a&lt;/sup&gt; (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>enteropathogenic</td>
<td>Female (73)</td>
<td>36 (49)</td>
<td>10 (14)</td>
<td>50 (70)</td>
<td></td>
</tr>
<tr>
<td><em>Yersinia</em></td>
<td>Male (78)</td>
<td>31 (40)</td>
<td>7 (9)</td>
<td>47 (60)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not known (2)</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All animals (153)</td>
<td>68&lt;sup&gt;b&lt;/sup&gt; (44)</td>
<td>17&lt;sup&gt;c&lt;/sup&gt; (11)</td>
<td>99 (65)</td>
<td></td>
</tr>
<tr>
<td>ail-positive</td>
<td>Female (73)</td>
<td>28 (38)</td>
<td>9 (12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Y. enterocolitica</em></td>
<td>Male (78)</td>
<td>24 (31)</td>
<td>5 (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not known (2)</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All animals (153)</td>
<td>53 (35)</td>
<td>14 (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>inv-positive</td>
<td>Female (73)</td>
<td>17 (23)</td>
<td>2 (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Y. pseudotuberculosis</em></td>
<td>Male (78)</td>
<td>13 (17)</td>
<td>2 (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not known (2)</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All animals (153)</td>
<td>30 (20)</td>
<td>4 (3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> OD>0.2

<sup>b</sup> in 15 animals both pathogens were detected

<sup>c</sup> from one animal both pathogens were isolated
Table 2. Prevalence of enteropathogenic *Yersinia* among the 153 wild boars of different weights

<table>
<thead>
<tr>
<th>Weight (month)</th>
<th>No. of animals</th>
<th>Number of positive animals</th>
<th>PCR (%)</th>
<th>Culture (%)</th>
<th>ELISA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20 (&lt;6)</td>
<td>10</td>
<td>7 (70)</td>
<td>4 (40)</td>
<td>5 (50)</td>
<td></td>
</tr>
<tr>
<td>20-40 (6-12)</td>
<td>53</td>
<td>23 (43)</td>
<td>7 (13)</td>
<td>29 (55)</td>
<td></td>
</tr>
<tr>
<td>40-60 (12-24)</td>
<td>67</td>
<td>31 (46)</td>
<td>5 (7)</td>
<td>43 (64)</td>
<td></td>
</tr>
<tr>
<td>&gt;60 (&gt;24)</td>
<td>18</td>
<td>5 (28)</td>
<td>0 (0)</td>
<td>17 (94)</td>
<td></td>
</tr>
<tr>
<td>Not known</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>All animals</td>
<td>153</td>
<td>68 (44)</td>
<td>17 (11)</td>
<td>99 (65)</td>
<td></td>
</tr>
</tbody>
</table>

*a* estimated from the weight according to Brooks ([http://texnat.tamu.edu/symposia/feral/feral-16.htm](http://texnat.tamu.edu/symposia/feral/feral-16.htm)) and Hebeisen et al. (2008)

*b* OD>0.2
Table 3. Prevalence of enteropathogenic *Yersinia* in tonsils of 146 wild boars by PCR

<table>
<thead>
<tr>
<th>Species</th>
<th>No. of positive (%)</th>
<th>Number of positive animals (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in both tonsils</td>
<td>in one tonsils</td>
</tr>
<tr>
<td><em>Y. enterocolitica</em></td>
<td>17 (12)</td>
<td>35 (24)</td>
</tr>
<tr>
<td><em>Y. pseudotuberculosis</em></td>
<td>7 (5)</td>
<td>22 (15)</td>
</tr>
<tr>
<td>Enteropathogenic <em>Yersinia</em></td>
<td>30&lt;sup&gt;a&lt;/sup&gt; (21)</td>
<td>36 (25)</td>
</tr>
</tbody>
</table>

<sup>a</sup> in six animals, one tonsil was *Y. enterocolitica* positive and the other tonsil was *Y. pseudotuberculosis* positive

<sup>b</sup> in 15 animals both pathogens were detected
Table 4. Prevalence of enteropathogenic *Yersinia* in tonsils and faeces of 73 wild boars by PCR and culture methods

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of positive (%)</th>
<th>PCR</th>
<th></th>
<th>Culture</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Tonsils</td>
<td>Faeces</td>
<td>Tonsils</td>
<td>Faeces</td>
</tr>
<tr>
<td><em>Y. enterocolitica</em></td>
<td></td>
<td>26 (36)</td>
<td>4 (5)</td>
<td>6 (8)</td>
<td>1 (1)</td>
</tr>
<tr>
<td><em>Y. pseudotuberculosis</em></td>
<td></td>
<td>12 (16)</td>
<td>0</td>
<td>1 (1)</td>
<td>0</td>
</tr>
<tr>
<td>One of the species</td>
<td></td>
<td>33 (45)</td>
<td>4 (5)</td>
<td>7 (10)</td>
<td>1 (1)</td>
</tr>
</tbody>
</table>