Cryptosporidiosis reservoir in wild brown rats (*Rattus norvegicus*) in the UK

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SUMMARY

Rats (*n = 73*) were trapped from nine rural farms around Oxfordshire and faeces were examined using the auramine-phenol and the Modified Ziehl–Neelsen techniques. *Cryptosporidium parvum* oocysts were detected in the faeces from 46 (63%) rats. This suggests that wild rats represent a risk to human and livestock health through the carriage and transmission of this zoonotic protozoan.

*Cryptosporidium* spp. is a zoonotic pathogenic protozoan. It causes diarrhoeal illness in humans and livestock, and is a potentially life-threatening illness in immunosuppressed hosts [1]. Infection is contracted through ingestion of oocysts in contaminated water or foodstuffs, or following contact with infected animals as cross transmission between host species readily occurs [2, 3]. Because organisms of *Cryptosporidium* spp. were first recognized and described in the gastric glands of house mice (*Mus musculus*) in 1907 [4], both house and wild mice (*Apodemus sylvaticus*) are considered as important reservoirs for infection of humans and livestock [5, 6]. Wild brown rats (*Rattus norvegicus*), on the other hand, have to the authors’ knowledge never been considered or investigated as potential *Cryptosporidium* spp. reservoirs in the UK, despite their association with humans and livestock [7]. Both *C. parvum* and *C. muris* have, however, been detected in wild brown rats in Japan [8]. The aim of this study was to investigate whether wild brown rats on UK farms carry *Cryptosporidium* spp.

Rats (*n = 73*) were trapped from nine rural farms in Oxfordshire during 1993 (trapping every 4 months/site). Faeces (3–4 pellets/rat) were collected from the trap base prior to the rats release at the point of capture. Faecal samples were examined using the auramine-phenol technique, examined under ×200 and ×400 fluorescence microscopy [9], and the Modified Ziehl–Neelsen technique at ×400 and ×1000 bright field microscopy [10]. In order to confirm the presence of *Cryptosporidium* spp., oocysts in faeces were concentrated by a formal-ether method [11] prior to staining with an immunofluorescence antibody test using a genus specific monoclonal antibody known to react to *C. parvum, C. muris* and *C. bailey* (Shield Diagnostics, Dundee, UK) [12].

*Cryptosporidium parvum* oocysts were detected in the faeces from 63% of rats, from 6 out of the 9 farms sampled. There were no sex or age effect, but there were
Table 1. Prevalence of Cryptosporidium parvum in wild brown rats

<table>
<thead>
<tr>
<th>Rats</th>
<th>Number</th>
<th>Number + ve</th>
<th>% + ve</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>73</td>
<td>46</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>30</td>
<td>18</td>
<td>60</td>
<td>0.65</td>
</tr>
<tr>
<td>Females</td>
<td>43</td>
<td>28</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Juveniles</td>
<td>8</td>
<td>7</td>
<td>87</td>
<td>0.27</td>
</tr>
<tr>
<td>Subadults</td>
<td>12</td>
<td>8</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>Adults</td>
<td>53</td>
<td>31</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>20</td>
<td>19</td>
<td>90</td>
<td>0.001</td>
</tr>
<tr>
<td>Summer</td>
<td>16</td>
<td>2</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Autumn</td>
<td>22</td>
<td>13</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Winter</td>
<td>15</td>
<td>12</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

* P value determined using the \( \chi^2 \) test.

Juveniles (<100 g), subadults (100–200 g), adult rats (>200 g). Spring (March–May), summer (June–August), autumn (September–November), winter (December–February).

significant prevalence differences between seasons, with spring and winter peaks and a summer trough (Table 1). Oocysts of *C. muris* were not detected.

*Cryptosporidium* spp. oocysts are often excreted in large numbers in a fully sporulated, highly resistant and infective form and the infective dose is probably small [13]. Cryptosporidiosis in humans and livestock is usually caused by *C. parvum* rather than *C. muris* [3]. Thus, wild brown rats, as *C. parvum* carriers, may present a risk to the health of humans and livestock, as do mice [14]. Moreover, the seasonal distribution of *C. parvum* prevalence in wild rats (Table 1) is of potential importance since rats in the UK tend to migrate into the farm buildings to feed on stored grain during cold weather, whilst in summer and autumn they move out to the fields to feed on growing crops [15]. Thus, *C. parvum* prevalence is highest at a time when rats are most likely to have contact with humans and livestock.

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REFERENCES

Cryptosporidium parvum in wild brown rats