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

J. P. WEBSTER AND D. W. MACDONALD

Wildlife Conservation Research Unit, Department of Zoology, University of Oxford, South Parks Road, Oxford OX1 3PS

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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 slyvaticus*) 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 $\times 200$ and $\times 400$ fluorescence microscopy [9], and the Modified Ziehl–Neelson technique at $\times 400$ and $\times 1000$ 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 immunoflourecence 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*

	Rats			
	Number	Number + ve	% + ve	*P**
Total	73	46	63	
Males	30	18	60	0·65
Females	43	28	65	
Juveniles	8	7	87	0·27
Subadults	12	8	67	
Adults	53	31	58	
Spring	20	19	90	0·001
Summer	16	2	12	
Autumn	22	13	59	
Winter	15	12	80	

* P value determined using the χ^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

1. Perryman LE. *Cryptosporidium* in rodents. In: Dubey JP, Speer CA, Fayer R, eds. *Cryptosporidiosis of man and animals*. CRC Press, 1990: 125–32.
2. Fayer R, Ungar BIP. *Cryptosporidium* spp. and cryptosporidiosis. Microbiol Rev 1986; **59**: 458–83.
3. Casemore DP. Epidemiological aspects of human cryptosporidiosis. Epidemiol Infect 1990; **104**: 1–28.
4. Tyzzer EE. A sporozoan found in the peptic glands of the common mouse. Proc Soc Exp Biol Med 1907; **5**: 12–13.
5. Klesius PH, Haynes TB, Malo LK. Infectivity of *Cryptosporidium* sp. isolated from wild mice for calves and mice. J Am Vet Med Ass 1986; **199**: 192–3.
6. Cox FEG. Parasitic protozoa of British wild mammals. Mammal Rev 1970; **1**: 1–28.

7. Meehan AP. Rats and mice: their biology and control. The Rentokil Library, Rentokil Ltd. Tonbridge, Kent: Brown Knight & Truscott Ltd, 1984.
8. Iseki M. Two species of *Cryptosporidium* naturally infecting house rats, *Rattus norvegicus*. Jpn J Parasit 1986; **35**: 251–6.
9. Casemore DP, Armstrong M, Sands RL. Laboratory diagnosis of cryptosporidiosis. J Clin Pathol 1985; **35**: 1337–41.
10. Henriksen SA, Pohlenz JFL. Staining of *Cryptosporidium* by a modified Ziehl–Neelsen technique. Acta Vet Scand 1981: **22**: 594–6.
11. Casemore DP. Broadsheet 128: laboratory methods for diagnosing cryptosporidiosis. J Clin Pathol 1991; **44**: 445–51.
12. McLauchlin J, Casemore DP, Harrison TG, Gerson PJ, Samuel G, Taylor AG. Identification of *Cryptosporidium* oocysts by monoclonal antibody. Lancet 1987; i: 51.
13. Casemore DP, Sands RL, Curry A. *Cryptosporidium* species a 'new' human pathogen. J Clin Pathol 1985; **38**: 1321–36.
14. Chalmers RM, Sturdee AP, Casemore DP, et al. *Cryptosporidium muris* in Wild House Mice (*Mus musculus*): First report in the UK. Europ J Protistol 1994; **30**: 151–5.
15. Huson LW, Rennison BD. Seasonal variability of Norway rat (*Rattus norvegicus*) infestation of agricultural premises. J Zoo Lond 1981; **194**: 257–89.