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Mycobacterial disease in cats in Great Britain: I. Culture results, geographical distribution and clinical presentation of 339 cases

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This study investigated 339 cases of feline mycobacterial disease from cats with cutaneous lesions or masses found at exploratory laparotomy. Tissue samples were submitted to the Veterinary Laboratories Agency for mycobacterial culture over a 4-year period to December 2008. The study assessed which species of culturable mycobacteria were involved, where the cats lived, and their clinical presentation (physical findings, serum biochemistry, radiography, feline leukaemia virus and feline immunodeficiency virus status). *Mycobacterium microti* was cultured from 19%, *Mycobacterium bovis* 15%, *Mycobacterium avium* 7%, non-*M avium* non-tuberculous mycobacteria 6%, with no growth in 53% of samples. *M microti*, *M bovis* and *M avium* were found in almost mutually exclusive clusters within Great Britain (GB) (ie, *M bovis* in South-West England/Wales/Welsh Border, *M avium* in eastern England and *M microti* south of London and in South-West Scotland). While differences were seen in the clinical presentation and distribution of lesions caused by the different infections, these were not sufficiently different to be diagnostic. Cats commonly presented with single or multiple cutaneous lesions (74%), which were sometimes ulcerated or discharging, located most frequently on the head (54%). Lymph nodes were usually involved (47%); typically the submandibular nodes. Systemic or pulmonary signs were rarely seen (10–16%). When a cat is suspected of having mycobacteriosis, accurate identification of the species involved helps to determine appropriate action. Our findings show that knowing the cat's geographic location can be helpful, while the nature of the clinical presentation is less useful. Most cases of feline mycobacterial disease in GB are cutaneous.

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Mycobacterial infections are recognised as a global health concern, both in humans and other animals.[1–3] One species that is known to be infected by a number of different mycobacteria is the domestic cat. Unfortunately, many aspects of mycobacterial infections in this species remain unknown; there have been few recently published research papers on feline mycobacteriosis in general, and even fewer on feline tuberculosis in particular.[4]

Mycobacterial disease in the domestic cat can result in several different syndromes including tuberculosis (typically caused by *Mycobacterium bovis* or *Mycobacterium microti*), feline leprosy (*Mycobacterium lepraemurium*, and other similar bacteria), and non-tuberculous mycobacteriosis caused by non-tuberculous mycobacteria (NTM) (*Mycobacterium fortuitum*, *Mycobacterium avium–intracellulare* complex [MAC], and others).[5–14] In the UK, the majority of recently reported cases of feline mycobacterial disease have been primarily cutaneous in nature and they presented with nodules, draining tracts, ulceration and local lymphadenopathy.[4] Where systemic disease is seen, infection with a member of the tuberculosis group or a MAC organism is most likely[8,15] although occasional cases have been seen with other NTM.[16]

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Table 1. Mycobacterial culture results. The samples had histopathological changes indicative of mycobacterial infection and were submitted to the Veterinary Laboratories Agency for mycobacterial culture between January 2005 and December 2008.

Culture results	Number	Percentage (%) of cultured
M microti	63	39.6
M bovis	52	32.7
Non-tuberculous mycobacteria (NTM)		
M avium	24	15.1
M malmoense	4	2.5
M fortuitum	4	2.5
M celatum	1	0.6
M intracellulare	1	0.6
Unclassified	10	6.3
Cultured total	159	
No growth	180	
Grand total	339	

(47%: 95% CI 41−52) of the samples. Of these 159 samples, three species made up 87% of the isolates (*M microti*: 40%, *M bovis*: 33% and *M avium*: 15%, Table 1).

Complete postcodes were available for 277 samples and incomplete postcodes for 49 samples, with no postcode available for 13 samples. SaTScan analysis of the 326 samples with complete or incomplete postcodes revealed that there were no apparent clusters in terms of being able to culture a sample ($P = 0.544$, Fig 1a). The samples with no postcode information were two *M bovis* and 11 no growth.

The spatial distribution for the *M microti* samples and some of the *M bovis* samples have already been published by Smith et al,[13] who focused on *M microti*-positive samples from cats collected by the VLA over the last 14 years, and they found there were two areas where *M microti* dominated; Northern England/Southern Scotland and Southern England (Fig 1b). The current SaTScan analysis identified two smaller more well defined *M microti* clusters within these areas; one south of London and the other in South-West Scotland ($P < 0.015$). All of the 10 culture-positive samples in

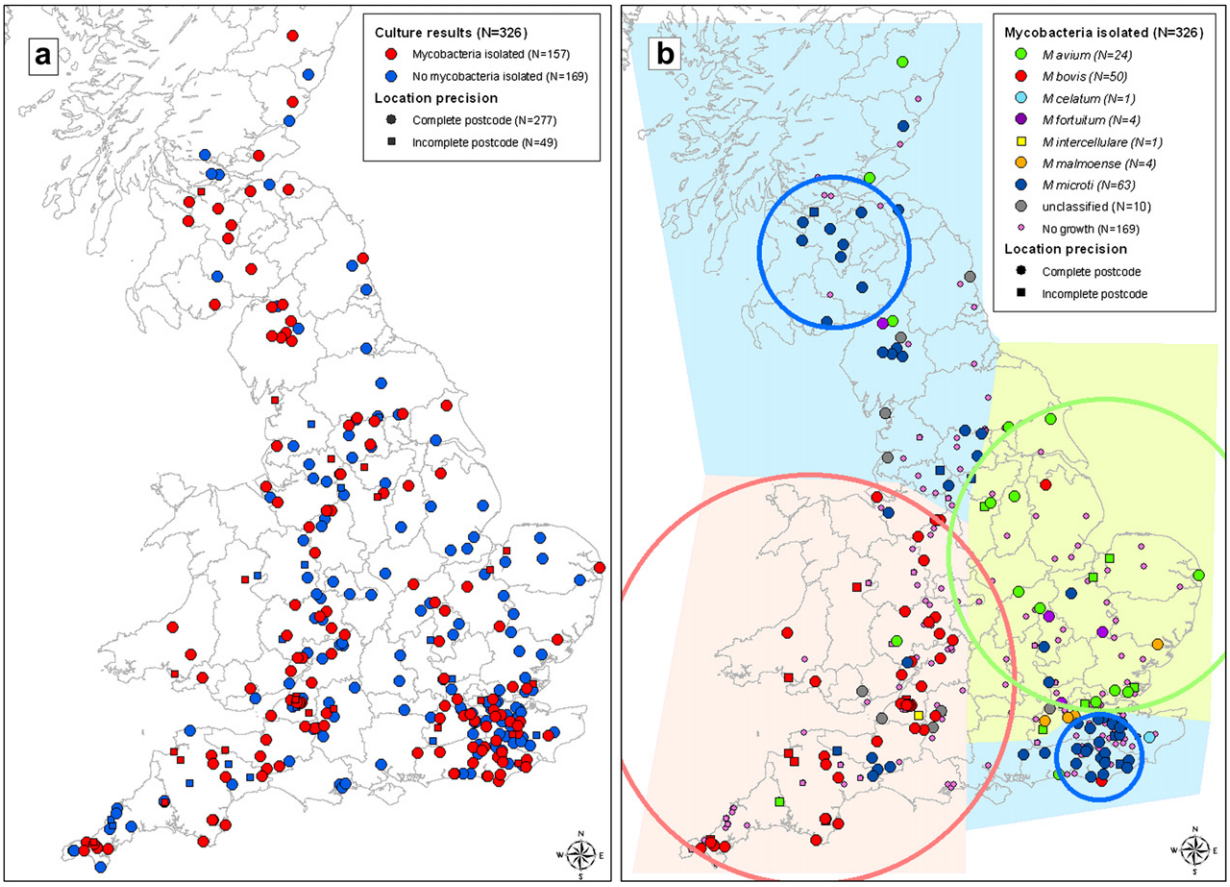

Fig 1. Map of GB showing the location of 326 feline samples obtained between January 2005 and December 2008 for which the VLA tried to culture mycobacteria. (a) Samples have been subdivided into samples that could (red symbols) and could not be cultured (blue symbols). (b) Samples which could be cultured were subdivided into either the *Mycobacteria* species isolated or as unclassified mycobacteria. Also indicated is whether the position on the maps is from a complete postcode (●) or the mean easting and northing of the postcode district (■). The coloured shaded areas correspond to predominance by one *Mycobacteria* species and the coloured circles the spatial clusters identified by the SaTScan analysis.

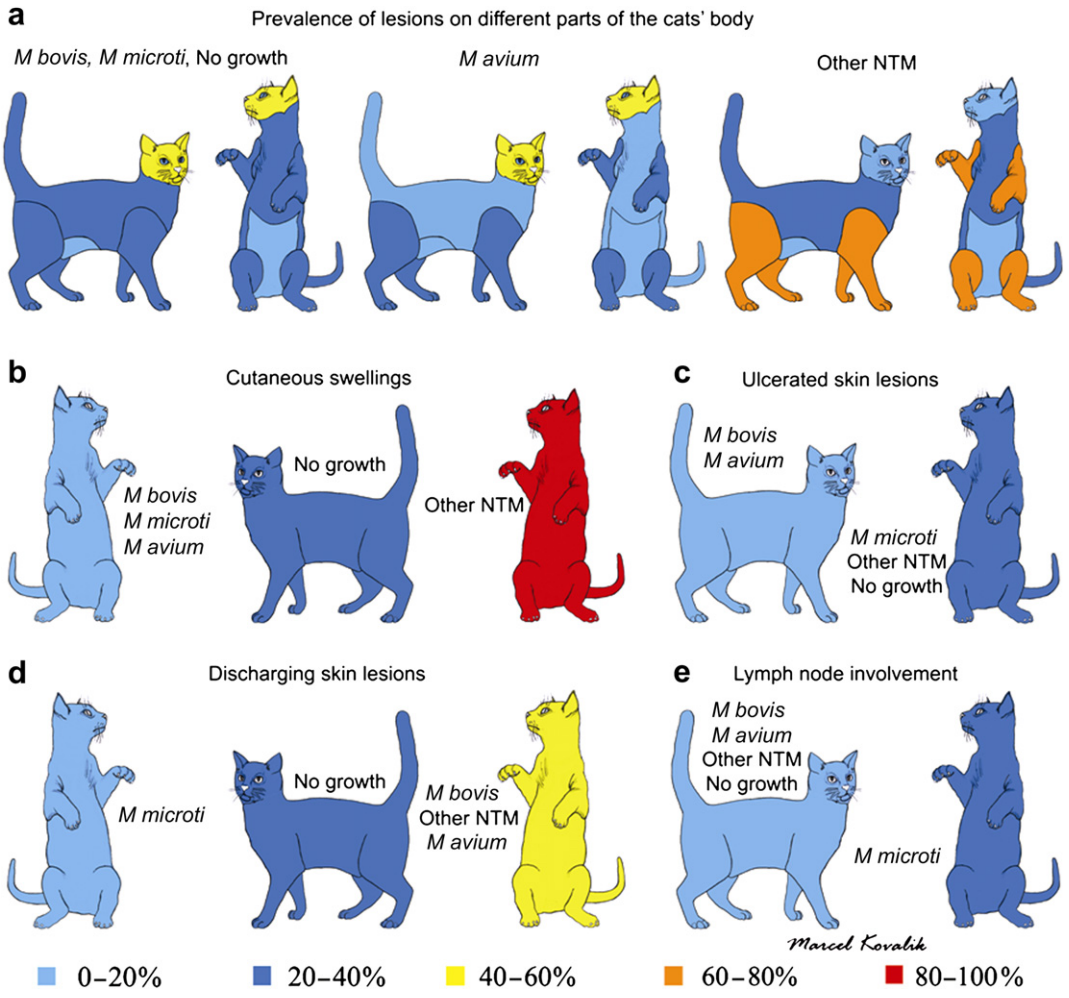

Fig 3. Pictorial representations of the (a) prevalence of lesions due to the different infections on different parts of the cats' body, (b) the overall prevalence of cutaneous lesions, and whether they were (c) ulcerated or (d) discharging lesions, and (e) whether there was lymph node involvement.

account for a third of the submitted cases. While there have been few recently reported cases of feline tuberculosis, those that have been published were also caused by either *M microti* or *M bovis*, or they quote or present VLA data.[4,13,15,31–33] No cases of *Mycobacterium tuberculosis* were identified, probably because cats are thought to be naturally resistant to this infection,[18,34] in addition to which this infection is now much less prevalent in the human population of GB.[35] Importantly, our findings confirm that *M microti* is a significant pathogen of cats in GB.[13,15,36] Confusingly, *M microti* infection in cats was previously termed *M microti*-like as it was unclear at the time that it was actually the same organism.[15,37,38] In addition, some reports have discussed cases where the infection was reported to be *M tuberculosis*[39] or *M tuberculosis* var *bovis*,[15,40] which on further investigation appear to have been *M microti*. The current study isolated *M avium* less frequently than *M microti* or *M bovis* and this is in agreement with current literature where few cases of this infection have been reported in cats.[8,41–43]

The data in the current study was also divided into four groups so that the two most important infections (*M microti* and *M bovis*) could be clearly defined, and then compared to the more heterogeneous NTM and the no-growth group. Since successful culture of *M bovis* can take up to two months and *M microti* can take up to three months[13] and access to molecular diagnostics is currently still limited and expensive, one aim of the study was to determine if it was possible to predict which mycobacterial species was present based on the cat's geographical location within GB and its clinical presentation.

Analysis of the postcode data showed that when a cat's location was mapped within GB there was marked clustering of the three most significant infections. The two *M microti* clusters have previously been reported by Smith et al[13] with one cluster south of London and the other in Northern England/Southern Scotland (Fig 1b). In addition, most of the isolates found in South-West England/Wales/Welsh Border were *M bovis* (Fig 1b). This confirms the reported spatial distribution