**Introductory statement**

*Mycobacterium avium* subspecies *paratuberculosis* (*M. paratuberculosis*) is the causal agent of Johnes Disease (JD) or paratuberculosis, which is a serious wasting disease predominantly of cattle, sheep and goats. Australia is in the fortunate position of having relatively little JD compared to most developed agricultural countries. Large areas of the continent are JD free and a high proportion of livestock populations have no known infection. Studies indicate that a small proportion of macropods can become infected with *M. paratuberculosis* when grazing with sheep infected with *M. paratuberculosis*. However, excretion of large numbers of viable organisms is rare in macropods, and it is unlikely that macropods provide a wildlife reservoir of infection that would seriously compromise control efforts for paratuberculosis in sheep (Cleland *et al*., 2010). The situation in cattle is not known.

**Aetiology**

*M. paratuberculosis* a slow growing, nonsporing, nonmotile, Gram positive acid fast bacterium. Multiple strains of the bacteria exist with the bovine strain usually infecting cattle, goats, camelids and deer and the ovine strain infecting sheep and goats.

**Natural hosts**

JD is primarily a disease of ruminants and camelids. Infection with *M. paratuberculosis* has been reported in other species including rabbits and macropods (Williams 2001). *M. paratuberculosis* has only been reported in wild macropods in association with sheep infected with ovine JD (Cleland *et al*., 2010).

**World distribution**

JD is found worldwide. The presence of *M. paratuberculosis* in macropods has only been reported in Australia.
**Occurrences in Australia**

A study was performed to determine whether *M. paratuberculosis* infection was present in macropods grazing with infected sheep on Kangaroo Island, South Australia in 2001–2002, and to assess the likely role of such infection in the epidemiology of ovine paratuberculosis (below) (Cleland *et al.*, 2010). Ileum and associated lymphatics from 482 macropods (427 Tammar wallabies (*Macropus eugenii decres*) and 55 western grey kangaroos (*Macropus fuliginosus fuliginosus*)) were examined using radiometric culture followed by PCR for IS900 and restriction endonuclease analysis (REA) for species identification, and isolates were strain typed using PCR for IS1311 and REA. Ileum and mesenteric lymph nodes from animals with positive tissue cultures or gross lesions suggestive of paratuberculosis were examined histologically. Faeces from a total of 840 animals were cultured in pools of 20, and individual faecal cultures were done from tissue culture positive animals, from those with microscopic lesions, and from selected animals with gross lesions. Eight animals (1.7%) yielded positive tissue cultures, and all isolates were the sheep (S) strain.

No significant difference was found between the proportions of infected animals of the two species; 2/55 kangaroos (3.6%) and 6/454 wallabies (1.3%) had positive tissue cultures (*P = 0.21*). Positive cultures were more frequent (*P < 0.01*) from animals with gross lesions (5 from 64) than from those without gross lesions (3 from 418).

Two animals that were tissue culture positive also had histopathological evidence of paratuberculosis. Twelve culture negative animals had microscopic lesions consistent with mycobacterial infection, and *M. genavense* was identified by PCR from a paraffin block from one of these animals. All faecal cultures were negative. These results indicate that a small proportion of macropods can become infected with *M. paratuberculosis* when grazing with infected sheep (Cleland *et al.*, 2010).

Another study in the Tablelands of NSW examined 300 rabbits and 300 eastern grey kangaroos (*Macropus giganteus*). All were negative by culture and none had lesions, although one kangaroo was faecal culture positive. It was concluded that this animal was not infected but had ingested bacteria from contaminated pasture which had survived passage through the gut (Abbott 2002).

These results suggest that *M. paratuberculosis* is likely to be found in macropods at very low prevalence when these animals are grazing with sheep infected with ovine JD in Australia.¹

**Epidemiology**

Transmission of *M. paratuberculosis* is by the faecal-oral route in domestic animals.

The possibility that wildlife may be involved in the epidemiology of ovine JD in Australia was examined previously in two limited studies on endemically infected sheep farms, but there are no published reports in readily accessible refereed journals. In a study in Victoria, ileum, ileocaecal valve, caecum, proximal colon, mesenteric lymph nodes and faeces from 100 eastern grey kangaroos (*Macropus giganteus*) were cultured for

¹ No states in Australia are free of ovine JD with Western Australia, Northern Territory, Queensland, South Australia, most of NSW and western Victoria classified as low prevalence areas, Tasmania, the rest of Victoria, south-eastern NSW and Kangaroo Island as medium prevalence areas and the ACT and surrounding areas of NSW classified as high prevalence areas (Animal Health Australia 2010). Bovine JD occurs in NSW, Victoria, Tasmania and South Australia. Western Australia is free of the disease and Queensland and the Northern Territory are classified as Protected Zones.
M. paratuberculosis, and all results were negative (Kluver et al., 2000). In a second study, 206 eastern grey kangaroos from New South Wales were examined by faecal culture, and a subset of 94 kangaroos was examined also by smear and histopathology (Abbott, 2000). One kangaroo had low numbers of M. paratuberculosis in faeces, but there were no histopathological lesions in that or any other animal. The tentative conclusion from these early studies was that if paratuberculosis was present in Australian macropods, it was probably at low prevalence and of little significance in the epidemiology of the disease in sheep.

The later study by (Cleland et al., 2010) assessed the likely role of infection of macropods with M. paratuberculosis in the epidemiology of ovine JD. In the main study M. paratuberculosis was isolated from 1.7% of macropods, indicating that a small proportion of macropods can become infected when grazing with infected sheep. However, excretion of large numbers of viable organisms was rare in macropods, and it was concluded that it was unlikely that macropods would provide a wildlife reservoir of infection that would seriously compromise control efforts for ovine JD in sheep.

PFC from all 840 animals were negative for M. paratuberculosis, as were the individual faecal cultures from 46 macropods. These findings, together with the results from two earlier studies (Abbott, 2000; Kluver et al., 2000) indicate that excretion of sufficient numbers of viable M. paratuberculosis to be detected by the standard culture techniques used for this organism is rare in macropods. Thus it is unlikely that M. paratuberculosis would be maintained in macropod populations in the absence of infected sheep, and macropods are unlikely to provide a wildlife reservoir of infection that would seriously compromise control efforts in sheep. In the main study 2 of 18 animals with gross lesions from Farm 8 (11%) were culture positive, whereas in the follow-up studies, conducted after infected mobs of sheep had been culled, no infections were found among 33 animals with gross lesions. This difference is not statistically significant (P = 0.12), but does suggest that paratuberculosis may not persist in macropod populations in the absence of heavily infected sheep. These studies do not, however, rule out a role for macropods as passive transport hosts for the organism (Cleland et al., 2010).

**Clinical signs**

No clinical signs have been reported. A brief note was made of young unidentified macropods in south-east South Australia with progressive weight loss that had a heavy infiltration of epithelioid cells containing acid-fast bacteria in their mesenteric lymph nodes. However, culture results were not reported so the condition was not confirmed as JD (Tham 1991).

**Diagnosis**

Radiometric culture followed by PCR for IS900 and restriction endonuclease analysis (REA) for species identification, and strain typing of isolates using PCR for IS1311 and REA was used by Cleland et al., (2010) for diagnosis. In addition, ileum and mesenteric lymph nodes from animals with positive tissue cultures or gross lesions suggestive of paratuberculosis were examined histologically. Faeces were also cultured from tissue culture positive animals, from those with microscopic lesions, and from selected animals with gross lesions.

**Pathology**

A report examining the prevalence of M. paratuberculosis in macropods mentions that two animals which cultured positive for the bacteria “had lesions which were histopathologically consistent with ovine JD”
without describing the nature of the lesions. However, a wallaby is described in a table within the report as having “severe granulomatous enteritis”, presumably of a type consistent with JD (Cleland et al., 2004 and 2010).

**Differential diagnoses**

Differential diagnoses in macropods include any diseases that cause a loss of body condition including lack of forage, dental problems, and parasitism (Williams 2001). Histological lesions suggestive of *M. paratuberculosis* infection in the mesenteric nodes of some macropods may be due to infection with other mycobacteria (Cleland et al., 2010).

**Laboratory diagnostic specimens**

A complete necropsy should be performed. Samples of ileum, mesenteric lymph node and any lesions should be submitted fresh for culture and in formalin for histopathology.

**Laboratory procedures**

An acid fast stain on formalin fixed tissue may detect bacteria in the ileum or lymph node (Cleland et al. 2004 and 2010). Culture techniques are the same as those employed for ruminants. *M. paratuberculosis* grows slowly and cultures need to be incubated for a minimum of 12 weeks. Any growth is confirmed using PCR (Abbott 2002).

**Treatment**

There is no treatment.

**Prevention and control**

Prevalence of *M. paratuberculosis* in macropods grazing with sheep infected with OJD is extremely low, less than 1%, so prevention and control measures are not warranted (Abbott 2002). The situation associated with cattle is not known.

**Surveillance and management**

All isolates of *M. paratuberculosis* from macropods tested by Cleland et al., 2010 were of the S strain. This strain is responsible for the vast majority of sheep infections on KI and in Australia generally, but only rarely crosses species to affect other ruminants (Moloney and Whittington, 2008). Exposure of young ruminants to high levels of infection is required for this to occur, and the disease in other species may be milder than in sheep. The results of the current study indicate that a similar situation is likely for macropods infected with S strain. However, it would be unwise to extrapolate these findings to possible macropod infection with bovine strains of *M. paratuberculosis*, which are known to readily infect other species.

Wildlife disease surveillance in Australia is coordinated by the Wildlife Health Australia. The National Wildlife Health Information System (eWHIS) captures information from a variety of sources including Australian government agencies, zoo and wildlife parks, wildlife carers, universities and members of the public.
Coordinators in each of Australia’s States and Territories report monthly on significant wildlife cases identified in their jurisdictions.

There is no targeted surveillance program, AUSVETPLAN or Import Risk Analysis for *M. paratuberculosis* in Australian wildlife. However, infection of Australian wildlife with *M. paratuberculosis* would be considered to fall under the category of “Interesting or unusual” conditions of interest, which are targeted for reporting as part of Australia’s general wildlife health surveillance system.

**Statistics**

There are no reports of infection of macropods with *M. paratuberculosis* in the National Wildlife Health Information System (www.wildlifehealthaustralia.com.au). NOTE: access to information contained within the National Wildlife Health Information System dataset is by application. Please contact admin@wildlifehealthaustralia.com.au.

**Research**

Given the extremely low prevalence of disease due to *M. paratuberculosis* in macropods and the very unlikely possibility that macropods could act as reservoirs of JD for transmission to livestock further research is probably not warranted at this time. Should funding become available it might be useful to confirm that ovine JD cannot be maintained in macropod populations without the presence of infected sheep. The role, if any, of macropods in the epidemiology of JD in cattle is yet to be assessed.

**Human health implications**

There is some discussion concerning a possible link between *M. paratuberculosis* and Crohn’s disease, a chronic granulomatous ileocolitis of humans (Williams 2001). However, given the low prevalence of infection in macropods they are unlikely to pose a significant risk for humans, even if a connection is established.

**Conclusions**

The study by Cleland *et al.* (2010) clearly indicates that a small proportion of macropods can become infected with *M. paratuberculosis* when grazing with infected sheep. However, excretion of large numbers of viable organisms is rare in macropods, and it is unlikely that macropods provide a wildlife reservoir of infection that would seriously compromise control efforts for paratuberculosis in sheep. Though passive spread probably occurs via kangaroos control efforts for ovine JD are best based on controlling disease by vaccinating the sheep rather than focusing activities on kangaroos.²

**Acknowledgements**

We are extremely grateful to the many people who had input into this fact sheet and would specifically like to thank the following Peter Holz, Philip Ladds (in procuring difficult to obtain references), Celia Dickason, Debby Cousins and Richard Whittington.

---

² Kangaroo Island now has a whole of island vaccination strategy involving a voluntary subsidised vaccination strategy.
References and other information


Updated: July 2016

To provide feedback on this fact sheet

We are interested in hearing from anyone with information on this condition in Australia, including laboratory reports, historical datasets or survey results that could be added to the National Wildlife Health Information System. If you can help, please contact us at admin@wildlifehealthaustralia.com.au.

Wildlife Health Australia would be very grateful for any feedback on this fact sheet. Please provide detailed comments or suggestions to admin@wildlifehealthaustralia.com.au. We would also like to hear from you if you have a particular area of expertise and would like to produce a fact sheet (or sheets) for the network (or update current sheets). A small amount of funding is available to facilitate this.

Disclaimer

This fact sheet is managed by Wildlife Health Australia for information purposes only. Information contained in it is drawn from a variety of sources external to Wildlife Health Australia. Although reasonable care was taken in its preparation, Wildlife Health Australia does not guarantee or warrant the accuracy, reliability, completeness, or currency of the information or its usefulness in achieving any purpose. It should not be relied on in place of professional veterinary consultation. To the fullest extent permitted by law, Wildlife Health Australia will not be liable for any loss, damage, cost or expense incurred in or arising by reason of any person relying on information in this fact sheet. Persons should accordingly make and rely on their own assessments and enquiries to verify the accuracy of the information provided.

Find out more at www.wildlifehealthaustralia.com.au
email admin@wildlifehealthaustralia.com.au
or call +61 2 9960 6333