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DO FERAL PIGS PLAY AN IMPORTANT ROLE IN NEW ZEALAND'S TB PROBLEM?

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INTRODUCTION

Despite sometimes having a high prevalence of bovine tuberculosis (Tb), feral pigs are generally regarded as spillover end-hosts unable to sustain the disease in the absence of infection in other species. Although intraspecific transmission occurs in captivity (Ray et al. 1972), transmission between feral pigs must be rare because there are few places in the world where Tb has persisted in feral pigs in the absence of infection in other species (Nugent et al. 2003a,b). The clearest evidence for end-host status is the decline in prevalence in pigs following the removal of infected cattle and buffalo from parts of the Northern Territory of Australia (McInerney et al. 1995). Countering this widespread belief, new evidence suggests Tb may have persisted in wild boar long isolated from livestock in Spain (Aranaz et al. 2004), and there is increasing suspicion that although not maintenance hosts in their own right, feral pigs do play some role as part of a wildlife complex in sustaining and spreading Tb in New Zealand. This paper summarises relevant insights from observations made during recent ecological and epidemiological investigations in New Zealand, focussing on three main areas: (i) additional evidence against intraspecific transmission between pigs; (ii) likely routes of transmission to and from pigs and their role in interspecific transmission; and (iii) the likely spatial scale and pattern of interspecific transmission involving pigs.

MAIN FINDINGS

Pigs readily become infected with Tb when infected brushtail possums (the primary wildlife host of Tb in New Zealand) are present (Lugton 1997). For example, all of 16 uninfected pigs released into Hochstetter Forest, West Coast (where 2-53% of possums were infected during the 1990s; Coleman et al. 1999), in 2000 became infected within about 2 months of release (Nugent et al. 2002). Likewise, on Muzzle Station, North Canterbury (where Tb is also present in possums but at lower levels), we detected Tb in 58% of 65 pigs (and 71% of the 31 pigs > 1 year old) during 2002-2004. However, no transmission of Tb to or between pigs was observed there when 8 or more Tb-free ‘sentinel’ pigs were held in continuous contact (for up to nine months) with 1 or more Tb-infected pigs in two 1 ha pens that excluded possums, ferrets, and livestock. The effective density of infected pigs in these pens exceeded 100/km², at least ten times higher than the density of wild pigs outside the pens. The well-fed pigs inside the pen did not cannibalise the carcasses of two pigs that died during the trial.

To assess potential routes of interspecific transmission, the fate of pig, deer, possum, and ferret carcasses have been monitored in five separate investigations. Pigs usually find and scavenge a high proportion (>50%) of possum carcasses within their home ranges, especially in winter (Barber, 2004; Nugent et al. 2004). This indicates that where pigs are abundant most infection in possums is likely to spill over into pigs. Video footage of pig families feeding simultaneously on a single possum carcass indicates how the numbers of wild animals infected with Tb could sometimes be amplified through scavenging. However pigs rarely cannibalise the remains of other pigs or feed on the carcasses of ferrets so pig-to-pig or ferret-to-pig transmission via scavenging is unlikely to be an important route of infection for pigs (Yockney and Nugent 2003, Byrom 2004). Conversely ferrets frequently fed extensively
on pig carcasses, and possum occasionally did so as well (Byrom 2004; Yockney and Nugent 2003). In one instance, a family of six ferrets together ate all of the edible tissue on a pig’s head (Yockney and Nugent 2003), indicating further potential for amplification of infection. Possums have also been recorded feeding on deer carcasses, usually only briefly but sometimes for extended periods (Nugent et al. 2003b), and on ferrets (Ragg et al. 2000; Byrom 2004), indicating potential for transmission of Tb from these predominantly spillover hosts back to a known wildlife maintenance host.

Pigs can potentially spread Tb long distances. One of the female pigs that became infected in the Hochstetter Forest trial (see above) left that area about six months after release, and was shot nine months later 35 km away in an area not known to contain infected possums. The timing of the shift, and the absence of infection in three other 5-month-old pigs (probably her offspring) shot with her, makes it likely that this sow was infected before dispersing, and carried the disease with her. For the released pigs in that study that did not disperse, a radius of about 6 km around the kill site encompassed 95% of all previous locations; i.e., even resident pigs can easily carry Tb up to 6 km (Nugent et al. 2002). Consistent with this, Tb prevalence in pigs in the Hauhungaroa Range, central North Island, declined from high to low levels when sampled across 7km of forest with few possums that lay immediately east of an area with high possum densities and levels of infection (Nugent et al. 2003).

CONCLUSIONS

Because the prevalence of Tb in pigs is often high, and because it has not been particularly difficult to obtain video footage of possums scavenging pigs or deer (Yockney and Nugent 2003), the risk of pig-to-possum transmission is likely of sufficient magnitude to be of management concern (unless very few of the interactions between possums and infected pig carcasses result in transmission). We therefore consider it likely that pigs will have contributed significantly to the historical spread of Tb in wildlife by transporting Tb long distances ahead of the Tb ‘front’ in possums, resulting occasionally (through scavenging of pigs by possums) in the establishment of new outlying foci of infection in possums. Both natural movements by pigs and transport of live or dead pigs by hunters would contribute to such spread.

Where Tb is already established in wildlife, we believe pigs are also likely to sometimes play an important role in spreading Tb from forested areas to farmland, via a four-species chain (possum-pig-ferret-livestock). The final link in this hypothetical chain is based on previously reported observations of close contact during interactions between ferrets and livestock (Sauter and Morris 1995). The observations above indicate that the first two links of this chain have high probabilities of occurrence, possibly even increasing the incidence of disease in wildlife through group scavenging. Transmission from ferrets to livestock must also be common, as ferret control reduces the incidence of infection in cattle even when possum are not controlled (Caley et al. 1998) and Tb has been detected in about 50% of cattle herds known to have infected ferrets present during the cattle-testing year (Caley 2003).

This chain of interspecific transmission is likely to be of greatest consequence when infected possums have been eliminated from farmed areas through possum control but are still present in adjacent unfarmed areas where possums are not controlled. Because both ferrets and pigs have large home ranges and disperse long distances, a transmission pathway like this would tend to produce outbreaks of infection in livestock within a radius of perhaps 10 km around any area in which infected possums are present, even where the possum density within that area is held at very low levels. The pattern intuitively expected would be one of widely
dispersed and unconnected herd breakdowns not closely associated with the forest-pasture margin, each herd breakdown lasting only 1-2 Tb-testing cycles.

As one example consistent with this predicted pattern, Tb has occurred sporadically between 1999 and 2003 in unconnected cattle herds spread widely through developed farmland near Featherston, east of the continuous scrubland and forests of the Tararua Range, lower North Island. Some of these sporadic breakdowns occurred after possum densities on the farmland had been reduced to very low levels (post-control trap catch rates of <1% in recent years) and moderate to low densities in the scrub and forest immediately to the west (trap-catch rates of 0.3-4.0%). Surveys in 2003 and 2004 did not detect Tb in c. 120 possums, yet Tb was detected in three ferrets in 2003 (but in none of 35 ferrets surveyed in 2004), and in 15% of 27 pigs surveyed in 2004 (unpubl. data).

Together, these observations suggest that pigs probably play a much more important role in the Tb problem in New Zealand than previously suspected, not as a maintenance host but as an amplifying and dispersive link in several chains of interspecific transmission. The management significance of this role is likely to increase with the decline in reactor herds under the NPMS. If so, key implications are (i) combined pig control and surveillance ahead of the Tb front in possums would probably help slow the rate of Tb spread in some places or at least better define where possum control was needed, and (ii) removal of distant reservoirs of Tb in possums could have a greater impact on the frequency of sporadic Tb-breakdowns in cattle and deer farms within possum-controlled areas than would intensifying possum control on those farms.

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REFERENCES


