Poultry virus infection in Antarctic penguins

Antarctic penguins appear to be relatively free of infectious diseases, although there is serological evidence of infection with a number of avian diseases found elsewhere[1–4]. An infectious agent is suspected in one case of mass mortality in Adélie penguin chicks, *Pygoscelis adeliae*[5] (Fig. 1), but there have been no confirmed reports of any major outbreaks of infectious disease. Here we report evidence for the occurrence of an avian pathogen, infectious bursal disease virus (IBDV), in wild Antarctic penguins. This raises concern for the conservation of avian wildlife in Antarctica.

Figure 1 Adélie penguin about to feed its chick.

IBDV is a pathogen of domestic chickens *Gallus domesticus*, but antibodies have been detected in a variety of wild aquatic bird species[6]. It affects lymphoid organs, primarily the bursa of Fabricius in chicks, the main site for the development of antibody-producing B-lymphocyte populations. Subclinical effects and immunosuppression, caused by even the less virulent strains of IBDV, retard growth and development and predispose the chick to opportunistic infections[7]. Morbidity and mortality rates in young chickens vary but can be high, especially in a newly emerged, globally spreading, high-virulence strain.

We inferred IBDV infection from the presence of specific antibodies in serum collected from both emperor (*Aptenodytes forsteri*) and Adélie penguins. We collected samples from 52 emperor penguin fledgling chicks (four to five months of age) from Auster Rookery (67° 23′ S, 64° 02′ E) in December 1995, and between September 1995 and February 1996 from 133 adult Adélie penguins from two colonies within 40 km of Mawson (67° 31′ S, 62° 48′ E) (Fig. 2). We used a standard virus neutralization test (VNT) to measure antibody titres[8]. Antibody titres of 1 in 80 or greater were regarded as positive[9]. Using this conservative criterion, the prevalence of positive VNT reactors was 65.4% in emperor penguin chicks and 2.1% and 2.6% in the two colonies of adult Adélie penguins. Infection with IBDV occurs principally in young birds[10] and so prevalence of seroreactors would decline with age.

We found no antibodies in Adélie serum taken from either chicks ($n=17$) or adult birds ($n=26$) in January 1996 from a remote and rarely visited colony at Edmonson Point (74° 21′ S, 165° 03′ E) in the Ross Sea (Fig. 2). In a retrospective analysis, the prevalence of antibodies in adult Adélie penguin serum collected at Mawson in January 1991 was 1.5% ($n=136$).

IBDV is relatively resistant to inactivation by heat, desiccation and chemical agents, and is contagious and highly infectious by the faecal–oral route[11]. It is likely to remain an environmental contaminant of colonies between breeding seasons. The recent rapid spread of the new highly virulent strains throughout most of the poultry industry in the Northern Hemisphere is testament to its potential for widespread dissemination. A potent source of environmental contamination in Antarctica could be from careless or inappropriate disposal of poultry products, allowing access by scavenging birds such as the south polar skua, *Catharacta maccormicki*. Spread within Antarctica could be facilitated through the movement of people carrying the virus on contaminated footwear, clothing, equipment or vehicles.

Although clinical disease was not apparent in either species of penguin, further investigation is warranted. The presence of seroreactors near centres of human activity raises the possibility that the virus may have been introduced. The size of our chick sample at Edmonson Point was sufficient to detect a prevalence of in excess of 20% seroreactors ($P<0.05$)[12]. If IBDV was present in this location, the seroprevalence would be expected to be similar to that among the equivalent age group of emperor chicks. Thus the absence of neutralizing antibodies in the chicks from this remote colony of Edmonson Point suggests that this area is free from IBDV contamination.

At this time, it must be assumed that IBDV may be pathogenic in Antarctic penguins, and is likely to be spread by human activity. The potential for expeditioners and tourists to be vectors of disease as they move around Antarctica may pose the greatest threat yet to its avian fauna.

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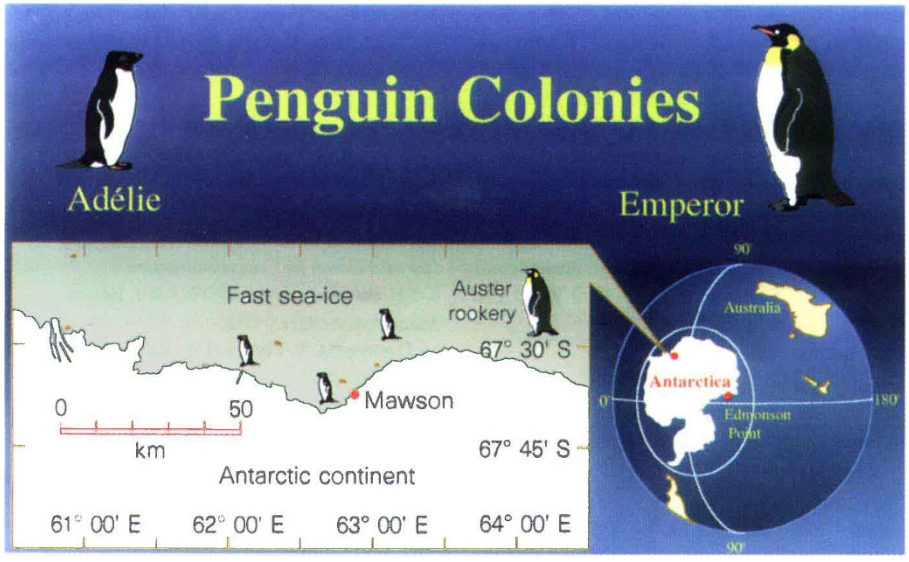

Figure 2 Antibodies to IBDV were identified in adult Adélie penguins at three sites within 40 km of Mawson and in emperor penguin chicks at Auster Rookery, 50 km east of Mawson. No antibodies were found in chicks or adult Adélie penguins from the remote colony at Edmonson Point in the Ross Sea.

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