Poxviruses and Australian wild birds

Fact sheet

Introductory statement

Avian poxviruses represent a large group of viruses, which infect most bird species throughout the world. In general, the viruses appear to have been present in bird populations for long periods of time leading to low levels of infection and relatively mild disease. However, where poxviruses have been introduced to naïve bird populations, they have the potential to cause explosive outbreaks of severe disease with high morbidity and mortality, such as occurred in Hawaii, the Galapagos and the Canary Islands.

Aetiology

Avian pox is caused by viruses of the genus *Avipoxvirus* in the family *Poxviridae*, subfamily *Chordopoxvirinae*. Poxviruses are large, 150 to 250 nm by 265 to 350 nm, double stranded enveloped DNA viruses. Currently there are 13 recognised species: fowlpox, turkeypox, canarypox, pigeonpox, quailpox, sparrowpox, starlingpox, juncopox, psittacinepox, peacockpox, penguinpox, mynahpox and albatrosspox. It is likely that this list will increase. Depending on host specificity these viruses are classified as mono-, bi-, or tri-pathogenic (van Riper and Forrester 2007, Bolte et al 1999).

Natural hosts

It seems likely that all bird species are susceptible to avian poxvirus infection. To date, avian pox has been recorded from 278 bird species from 70 families and 20 orders. There are no records of avian pox from tinamous (*Tinamiformes*), loons (*Gaviiformes*), nightjars (*Caprimulgiformes*) or kingfishers (*Coraciiformes*) (van Riper and Forrester 2007, Bolte et al 1999).

World distribution

Worldwide, except there are no published reports from wild birds in the Arctic or Antarctic.

Occurrences in Australia

Australian native species reported with poxvirus infection include the sooty tern (*Onychoprion fuscatus*), common noddy (*Anous stolidus*), lesser noddy (*Anous tenuirostris*), black swan (*Cygnus atratus*), Australian
magpie (Gymnorhina tibicen), magpie-lark (Grallina cyanoleuca), silvereye (Zosterops lateralis), shy albatross (Thalassarche cauta), peregrine falcon (Falco peregrinus), brown falcon (Falco berigora), Australian kestrel (Falco cenchroides), whistling kite (Haliastur sphenurus), butcher bird, tawny frogmouth (Podargus strigoides), emu (Dromaius novaehollandiae), red-tailed tropic bird (Phaethon rubricauda), black-faced cuckoo shrike (Coracina novaehollandiae), spinifex pigeon (Geophas plumifera), pied currawong (Strepera graculina), noisy pitta (Pitta versicolour), crow, little penguin (Eudyptula minor), white-winged chough (Corcorax melanorhamphos), and Cape Barren goose (Cereopsis novaehollandiae) (Ladds 2009, Annuar et al 1983, Sutton and Filippich 1983, Chung and Spradbrook 1977, Harrigan et al 1975). Psittacinepox is reported to be absent from Australia but there are reports of two cases of pox in crimson rosellas (Platycercus elegans) (Slocombe et al 2013). The relationship of the crimson rosella virus to the poxvirus syndrome associated with infection of South American parrots and parakeets (Amazona spp. and Ara spp.) with psittacinepox, which causes profound clinical disease, morbidity and death in these species, is not known.

**Epidemiology**

Poxviruses are extremely resistant, being able to survive on perches and in dried scabs for months to years. The viruses are resistant to ether with pigeonpox virus being resistant to chloroform as well. Poxviruses can withstand 1% phenol and 1:1000 formalin for nine days, but 1% potassium hydroxide, heating to 50°C for 30 minutes or 60°C for eight minutes will inactivate them (van Riper and Forrester 2007).

Poxviruses are most commonly transmitted by biting invertebrates such as mosquitoes, mites, midges or flies. In temperate regions, where vectors are not active during the winter, infections occur primarily in the summer and early autumn. In warmer areas avian pox can occur throughout the entire year but is most common during autumn and winter because host densities are highest due to large numbers of susceptible chicks.

Transmission can also occur directly by contact between infected and susceptible birds or by contact with contaminated objects such as bird feeder perches. However, poxviruses are unable to penetrate intact skin and need to gain entry through wounds.

Aerosol transmission by inhalation of dust contaminated with virus is rare but possible (van Riper and Forrester 2007).

Incubation period is seven to nine days for pigeons and from four days to three weeks for canaries (Macwhirter 2000).

Much is still unknown about the host spectrum of many of the poxviruses e.g. magpie poxvirus disease was experimentally transmitted to other magpies but not to chickens, turkeys, pigeons or canaries. Experimentally transmitted fowlpoxvirus caused disease in chickens and turkeys but not pigeons (Harrigan et al 1975).

Birds that have recovered from pox infections are usually immune to reinfection with that strain for six to twelve months (van Riper and Forrester 2007, Gartrell 2003).

**Clinical signs**

Lesions are most commonly found on featherless areas of the skin, usually on the feet and legs, or on the eyelids and base of the beak. They usually present as large wart-like nodules. These may be big enough to impair vision. Ulceration, haemorrhage and necrosis of the lesions may lead to myiasis and secondary bacterial infections. Lesions may extend into the oral cavity and involve the tongue and palate (Ladds 2009).
Diagnosis

Histological demonstration of intracytoplasmic inclusion bodies in hypertrophic epithelial cells is considered pathognomonic for poxvirus infection (Macwhirter 2000). This can be substantiated by using electron microscopy to demonstrate typical poxvirus particles. The virus can also be grown on chorioallantoic membranes of chicken embryos and identified using PCR techniques (van Riper and Forrester 2007).

Pathology

Grossly, pox lesions appear as firm nodules with a homogenous consistency on cut surface. Infections cause localized proliferations of epithelial cells. Affected cells become hyperplastic and hypertrophic. Hypertrophy and large granular acidophilic intracytoplasmic inclusions (Bollinger bodies) appear as the cells mature. These inclusion bodies contain typical dumbbell shaped pox particles (Ladds 2009, van Riper and Forrester 2007).

Differential diagnoses

Differential diagnoses include those diseases that can cause proliferative lesions on the head and legs, such as Knemidocoptes sp. infection (Holz et al 2005), and diseases, such as candidiasis, capillariasis and trichomoniasis, which can cause lesions in the oral cavity (van Riper and Forrester 2007).

Laboratory diagnostic specimens

A complete necropsy should be performed. Collect a range of tissues including any obvious lesions, and submit them in formalin for histopathology. Fresh or frozen tissues can be submitted for viral culture and PCR.

Laboratory procedures

Homogenates of affected tissues are inoculated onto the chorioallantoic membrane of 11 to 12 day old embryonated chicken eggs and incubated at 35 to 37°C for four to five days. The chorioallantoic membrane is then examined for pocks, which appear as greyish-white lesions ranging from 0.5 to 2.5 mm in diameter. When examined histologically the pocks contain large numbers of intracytoplasmic inclusion bodies (Annuar et al 1983, Harrigan et al 1975). However, it has been reported that strains of avian poxvirus isolated from falcons and penguins do not grow in chicken embryos (Krone et al 2004). The poxvirus isolated from the crimson rosellas also failed to grow in chicken embryos (pers. obs.).

Treatment

Poxvirus infections are generally self-limiting with uncomplicated lesions healing in three to four weeks. Secondarily infected lesions can be treated with topical antimicrobials. Systemic antibiotics and supportive treatment may aid recovery (Macwhirter 2000).

Prevention and control

Control of the disease in wild bird populations is difficult and should focus on reducing vectors, such as mosquitoes. Captive birds can be held in screened insect-proof enclosures. Any diseased birds should be
isolated and held in separate screened enclosures to prevent the disease spreading. Perches and feeders should be cleaned regularly with a disinfectant such as bleach (van Riper and Forrester 2007).

**Surveillance and statistics**

Australia’s general wildlife health surveillance system logs cases of poxviruses in wild birds in the national database.

Wildlife disease surveillance in Australia is coordinated by 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. NOTE: access to information contained within the National Wildlife Health Information System dataset is by application. See [www.wildlifehealthaustralia.com.au/ProgramsProjects/eWHIS-WildlifeHealthInformationSystem.aspx#requests](http://www.wildlifehealthaustralia.com.au/ProgramsProjects/eWHIS-WildlifeHealthInformationSystem.aspx#requests).

There are currently 22 cases of avian poxvirus infection in the National Wildlife Health Surveillance Database ([eWHIS www.wildlifehealthaustralia.com.au](http://www.wildlifehealthaustralia.com.au)) extending from 2002 to 2012. Birds listed include one little eagle (*Hieraaetus morphnoides*), four magpie-larks, one magpie, one Australian kestrel, one collared sparrowhawk (*Accipiter cerrocephalus*), and one red wattlebird (*Anthochaera carunculata*) from WA, one magpie from SA, one raven, and two crimson rosellas from Victoria, five black currawongs (*Strepera fuliginosa*), and one magpie from Tasmania, one silvereye, and two magpies from NSW.

The prevalence of avian pox in established wild bird populations is reported to be between 0.5 and 1.5%. In more naïve populations prevalence can be as high as 50% (van Riper and Forrester 2007).

**Research**

Avian poxvirus infection in Australian birds is far more common than the figures in the National Wildlife Health Surveillance Database suggest and little is known about the poxviruses that have been reported. The majority of them have not been characterised and there is almost no information on species specificity or transmission. We encourage those with veterinary or laboratory confirmed diagnoses of poxvirus infections in Australian native birds to submit this information to the national system for consideration for inclusion in the national database (contact [admin@wildlifehealthaustralia.com.au](mailto:admin@wildlifehealthaustralia.com.au)).

It also seems likely that previously unrecognised poxvirus strains exist in Australia, such as the one identified in crimson rosellas (above). Poxvirus seems to occur particularly frequently in magpies but it has not been determined if this is a new viral species or an already recognised species that has spilled over into magpie hosts.

More information is required on the cross protection of poxvirus vaccines.

**Human health implications**

None.
Conclusions

While avian poxviruses are likely widespread through the Australian avifauna relatively few reports of disease have appeared in the literature. Given the available information they do not appear to pose a threat to established populations of free ranging bird species. However, increasing global temperatures could potentially result in increased vector numbers and longer periods of vector activity possibly resulting in increasing incidence and prevalence of poxvirus infections. Ongoing surveillance and awareness of the possible consequences will be necessary to prevent or mitigate any resulting deleterious effects.

References and other information


Acknowledgements

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To provide feedback on this fact sheet

We encourage those with veterinary or laboratory confirmed cases of this condition in native Australian or feral animals to submit this information to the national system for consideration for inclusion in the national database. 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.

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