Herpesviruses and Australian wild birds

Fact Sheet

May 2024

Key points

- Avian herpesviruses (HV) are widespread globally and cause a large variety of diseases.
- Some herpesviruses cause significant disease in birds, including infectious laryngotracheitis and Marek's disease of poultry (gallid HV) and Pacheco's disease of parrots (psittacid HV).
- Herpesviruses establish latent infections which are followed by periodic excretion of virus during times of stress and debilitation.
- While avian herpesviruses are likely widespread through Australian wild birds, there are relatively few reports of disease.
- Ongoing surveillance and awareness of transmission risk is required to prevent herpesviruses from being introduced to naive populations and potentially causing disease outbreaks.

This Fact Sheet focuses on herpesviruses **other than psittacid herpesviruses** in wild Australian birds. For information on psittacid HV see the WHA Fact Sheet "Psittacid herpesviruses in birds in Australia". For information on exotic duck HV, see the WHA Fact Sheet "Exotic - Duck viral enteritis (herpesvirus)". This Fact Sheet does not discuss herpesviruses of domestic poultry.

Aetiology

Herpesviruses are enveloped DNA viruses. The family *Herpesviridae* is divided into three subfamilies: *Alphaherpesvirinae*, *Betaherpesvirinae* and *Gammaherpesvirinae*. All avian HV fall within *Alphaherpesvirinae* and are members of either the *Mardivirus* or *Iltovirus* genus.

One Health implications

Wildlife and the environment: there are relatively few reports of disease due to avian HV in Australian wild birds. Feral rock pigeons may be a source of HV infection for native birds, particularly raptors, putting them at risk of disease and HV related mortality. Specific HV species such as *Psittacid herpesvirus-1* and *Anatid herpesvirus-1* (duck viral enteritis) have the potential to cause significant disease in birds.

Domestic animals and humans: herpesviruses have been identified in a range of domestic bird species in Australia including racing pigeons and domestic waterfowl [1-6]. While the transmission of pathogenic HV from wildlife to domestic birds has been speculated, it has not been confirmed. Avian HV are not known to cause disease in non-avian species, nor in humans.

Natural hosts, world distribution and occurrences in Australia

Avian HV are found worldwide and have been found in all orders of birds. However, severe disease usually only occurs when viruses specific for a particular species find their way into unfamiliar hosts or if infected birds are immunocompromised in some way.

Columbid alphaherpesvirus 1 (CoAHV-1) is considered endemic in feral pigeons across Australia [7]. Columbid and other alphaherpesviruses have been isolated from several wild native Australian bird species (see Table 1). In Australian wild birds, disease associated with CoAHV-1 has been reported in a powerful owl (*Ninox strenua*), barking owl (*N. connivens*) and Australian hobby (*Falco longipennis*) [7, 8]. A sacred kingfisher (*Todiramphus sanctus*) and a sulphur-crested cockatoo (*Cacatua galerita*) displayed signs of disease that may have been associated with HV infection [9, 10].

Alphaherpesviruses have also been identified in a range of captive and feral bird species in Australia including racing pigeons, feral rock pigeons (*Columbia livia*) and captive waterbirds [black swans (*Cygnius atratus*), Cape Barren geese (*Cereopis novaehollandiae*)] and domestic geese and ducks] [1-6]. Herpesvirus disease and mortality has been reported in racing pigeons and domestic geese, ducks and swans in Australia e.g. goose herpesvirus [3-5, 11]. Herpesvirus infections and mortality in raptors have been reported from Europe, North America, Middle East and Asia, thought to be through the ingestion of infected feral pigeons [12-15]. Alphaherpesviruses have caused disease in Gouldian finches (*Erythrura gouldiae)* in Europe and North America and a little blue penguin (*Eudyptula minor*) in the USA but there are no reports of HV-associated disease in these species in Australia [16-18].

Table 1: Wild Australian native birds found to be positive on PCR for avian herpesviruses. Species in which clinical signs have been associated with avian herpesviruses are in bold. Note: this table does not include data on psittacid HV, gallid HV, or goose HV.

[#] Identified via cell culture

Herpesvirus species	Avian species	References
Alphaherpesviruses		
Columbid alphaherpesvirus 1 (CoAHV-1)	**Barking owl (*Ninox connivens*)** **Powerful owl (*N. strenua*)** **Australian hobby (*Falco longipennis)*** Forest kingfisher (*Todiramphus macleayii*) Sacred kingfisher (*T. sanctus*) Laughing kookaburra (*Dacelo novaeguineae*) Little corella (*Cacatua sanguinea*) Long-billed corella (*C. tenuirostris*) Sulphur-crested cockatoo (*C. galerita*) Australian king-parrot (*Alisterus scapularis*) Bar-shouldered dove (*Geopelia humeralis*) Crested pigeon (*Ocyphaps lophotes*) Rose-crowned fruit-dove (*Ptilinopus regina*) Spotted dove (*Spilopelia chinensis*) Wonga pigeon (*Leucosarcia melanoleuca*)	Phalen et al. 2011 [8] Kasimov et al. 2023 [10]

	Black-shouldered kite (*Elanus axillaris*) Brown goshawk (*Accipiter fasciatus*) White-bellied sea-eagle (*Haliaeetus leucogaster*) Nankeen Kestrel (*Falco cenchroides*) Barn owl (*Tyto alba*) Eastern grass owl (*T. longimembris*)	
Podargid alphaherpesvirus 1	Tawny frogmouth (*Podargus strigoides*)	Amery-Gale et al. 2018 [9]
Cacatuid alphaherpesvirus 1	Sulphur-crested cockatoo	Amery-Gale et al. 2018 [9]
Cacatuid alphaherpesvirus 2	Little corella	Sutherland et al. 2019 [19]
Unknown herpesvirus		
Unclassified herpesvirus	Little pied cormorant (*Microcarbo melanoleucos*)[#]	French et al. 1973 [20]

Epidemiology

Once infected with a HV, the host remains infected for life. The virus generally lies dormant within host cells ("latent" infection), causing no disease in the host until infection is reactivated by factors such as stress, immune compromise or concurrent infection. During the "lytic" (active) phase, the virus replicates within the host cell, and releases a new generation of viruses when the infected host cell lyses (is destroyed). Lytic infections can be transmitted to other individuals and can cause disease and mortality outbreaks.

Alphaherpesviruses have a moderately wide host range, rapid growth, lyse infected cells and tend to establish latent infections in nerve ganglia. Occasionally, infection is associated with significant clinical disease or mortality events if the host is stressed or immunocompromised, or if certain types of HV move from a natural host species into a different host species. There are three principal serotypes of the virus and infection with one serotype does not protect against infection with another.

Herpesvirus transmission generally requires close contact and usually occurs in birds by aerosol spread over short distances (inhalation of virus from feather dust or nasal secretions, saliva, urine and faeces). Birds, such as pigeons, that feed their offspring with crop milk, may transmit virus in the crop milk to their newly hatched offspring. Affected raptors likely contract the disease by feeding on infected pigeons [8, 21]. Vertical transmission through the egg has not been reported.

There have been limited studies on infection prevalence in wild pigeons, doves, raptors and other bird groups. Prevalence of avian HV in wild Australian birds presented to wildlife hospitals in Qld and Vic appears to be low, ranging from <1% to almost 9% [9, 10]. Comparatively, the prevalence of HV infection in feral pigeon flocks from NSW and Vic is high, ranging from 70-100%. The prevalence of CoAHV-1 in Australia is higher in raptors and pigeons compared to parrots and kingfishers [7, 10]. Feral rock pigeons appear to be a reservoir for avian herpesviruses in Australia, although one study identified CoAHV-1 in native pigeon and dove species, as well as a range of other avian species [10].

Clinical signs

No disease is seen in infected feral (rock) pigeons infected with CoAHV-1. Clinical signs in racing pigeons include inflammation of the oral mucosa, oropharynx and cloaca, rhinitis, dyspnoea, lethargy, weight loss, diarrhoea, vomiting, neurological signs and ulcers on mucous membranes [11, 22].

Affected raptors and waterbirds are commonly found moribund, or dead with no prior signs or after brief periods of lethargy and anorexia. Some domestic geese infected with HV have developed leg weakness and prostration prior to death. Affected Gouldian finches display dyspnoea, conjunctivitis, a head tilt, lethargy and sudden death [4, 5, 8, 17].

A wild sacred kingfisher with CoAHV-1 infection showed emaciation and cataracts, although it is unknown whether these clinical signs were as a result of the HV infection [10]. Similarly, a wild sulphur-crested cockatoo infected with CoAHV-1 presented emaciated, weak and with haemorrhagic enteritis. The cockatoo was co-infected with other pathogens and it is unknown whether these clinical signs were as a result of the HV infection [9]

Diagnosis

Clinical signs and histopathological lesions may be suggestive of HV infection. The presence of HV alone does not confirm a disease process, however a PCR positive bird can be assumed to have a lifelong HV infection.

Electron microscopy and PCR can also be used to detect clinically and subclinically-infected birds. PCR of oral or cloacal swabs is useful for antemortem diagnosis and molecular classification of infections [7].

In live birds the detection of antibodies in neutralisation tests will confirm previous exposure [21].

Laboratory diagnostic specimens and procedures

A complete necropsy should be performed. Collect a range of tissues, including liver and any obvious lesions, and submit in formalin for histopathology. Fresh or frozen tissues should also be submitted for viral culture and PCR [21].

Pathology

Affected raptors may have marked acute hepatic, splenic, pancreatic, intestinal and adrenal necrosis with intranuclear inclusion bodies [8, 9].

Affected waterbirds have similar hepatic lesions. Infected swans and Cape Barren geese had necrosis, haemorrhage and congestion throughout the gastro-intestinal tract and spleen. Domestic geese had haemorrhages on the liver and fibrinous enteritis [4, 5].

In contrast to raptors and waterbirds, Gouldian finches tend to have respiratory, rather than hepatic lesions, with tracheitis and necrotic epithelial cells, white blood cells, fibrin and cellular debris sloughing into the tracheal lumen, and intranuclear inclusion bodies. [16, 17].

Herpesvirus lesions (necrosis with intranuclear inclusions) of the respiratory or hepatic system have been described in pigeons [1, 2, 6].

Differential diagnosis

Differential diagnoses include any causes of sudden death such as trauma, mycotoxins, bacterial infections such as salmonellosis, fungal infections such as aspergillosis, other viral infections such as paramyxovirus and influenza, and viral infections that produce similar lesions, such as adenovirus [21].

Treatment

Treatment is difficult as infected birds are usually asymptomatic carriers or are found dead with no previous clinical signs. Treatment with antiviral medication will not cure the bird of infection and it will remain a lifetime carrier of the virus. See the WHA Fact Sheet "Psittacid herpesviruses in birds in Australia" for specific treatment of PsHV-1.

Prevention and control

A vaccine for avian herpesvirus in not available for wild birds in Australia [23]. Subclinically-infected captive birds (tested by PCR) can be held in isolation.

Feral pigeon carcasses are often fed to captive raptors; this carries a risk of transmission of CoHV-1 which can cause severe disease in raptors. Given the apparently high prevalence of CoHV-1 infection in feral pigeons it may be prudent to discontinue feeding dead pigeons to raptors and to maintain adequate feral pigeon control measures in raptor housing facilities [21].

As an enveloped virus, herpesviruses are readily inactivated by commonly used disinfectants. A specific herpesvirus, the infectious laryngotracheitis virus, is inactivated by temperatures of 58^{o}C for one hour, but may persist for many days in biological tissues [24].

Research

Further research is needed to assess the prevalence of HV in Australian wild bird species as well as host specificity and pathogenicity of novel herpesviruses recently identified. A vaccine is needed to help to protect at-risk species.

Surveillance and management

Wildlife Health Australia administers Australia's general wildlife health surveillance system, in partnership with government and non-government agencies. Wildlife health data is collected into a national database, the electronic Wildlife Health Information System (eWHIS). Information is reported by a variety of sources including government agencies, zoo based wildlife hospitals, sentinel veterinary clinics, universities, wildlife rehabilitators, and a range of other organisations and individuals. Targeted surveillance data is also collected by WHA. See the WHA website for more information https://wildlifehealthaustralia.com.au/Our-Work/Surveillance and

https://wildlifehealthaustralia.com.au/Our-Work/Surveillance/eWHIS-Wildlife-Health-Information-System.

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. Negative data are also valuable. If you can help, please contact us at admin@wildlifehealthaustralia.com.au.

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Wildlife Health Australia recognises the Traditional Custodians of Country throughout Australia. We respectfully acknowledge Aboriginal and Torres Strait Islander peoples' continuing connection to land, sea, wildlife and community. We pay our respects to them and their cultures, and to their Elders past and present.

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