Beak and feather disease virus (BFDV) **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Virus				Circoviridae

Common name psittacine beak and feather disease (English), beak-and-feather-disease-virus (English), psittacine circovirus disease (English)

Synonym

Similar species *Circovirus spp.*

Summary Beak and feather disease virus (BFDV) the causal agent of Beak and feather disease (BFD) is a small virus (14-16nm in diameter) with spherical symmetry and is referred to as a circovirus. BFD is one of the most commonly recognised viral diseases of wild psittacine birds worldwide and is characterised by chronic, progressive, symmetrical feather dystrophy and occasional beak deformity.

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Species Description
BFDV is described by Rahaus and Wolff (2003) as a small (14-16nm in diameter) non-enveloped virus with isometric or spherical symmetry. It is classified as a Circovirus.
\nTodd (2000) describes circoviruses as “small, non-enveloped, icosahedral viruses that are unique among animal viruses in having circular, single-stranded DNA genomes. The genomes being the smallest possessed by animal viruses.\"
Rahaus and Wolff (2003) describes the clinical symptoms shown by birds infected with this virus. The authors state that birds infected are, \"Characterised by a chronic, progressive, symmetrical feather dystrophy and occasional beak deformity. Typically, the first sign of BFD is a replacement of normal down and contour feathers with dystrophic feathers that stop growing shortly after emerging from the follicle. If beak lesions develop, they may include palatine necrosis, progressive elongation, and transverse or longitudinal fractures.\"
Todd (2000) states that, “birds usually die as a result of secondary infections, which supports the view that they are immunosuppressed (a condition characterised by a decrease in the body’s natural ability to fight infections and other foreign substances). The author observes that this condition is consistent with the detection of bursal and thymic lesions.
Todd (2000) further observes that clinical symptoms vary from species to species and also depends on the age of the bird. The most chronic form of the infection occurs in birds which are up to three years of age, although percute and acute forms of the infection have been reported in neonatal and very young birds.
The Commonwealth of Australia (2004) reports that, \"All members of the parrot family are susceptible to BFDV. However, susceptibility to infection varies with age and species, and between individuals of the same species. Susceptibility will also be influenced by environmental factors, such as climate, nutrition, habitat quality and social factors\".
Raidal *et al.* (1993) reported successful use of hemagglutination inhibition assays to detect the presence of BFDV in sera from wild sulphur crested cockatoos (*Cacatua galerita*), galahs (*Eolophus roseicapillus*), short-billed corellas (*Cacatua sanguinea*), eastern long-billed corellas (*Cacatua tenuirostris*) and other psittacine birds in New South Wales.
Ypelarr *et al.* (1999) report that, \"A universal PCR assay was designed that consistently detected BFDV in psittacine birds from different geographic regions across Australia.\"

Notes
Raidal (2004) reports that, \"Spontaneous recovery from acute BFDV can occur in many species, including budgerigars, lorikeets and lovebirds. Some acutely affected birds also recover. However, the majority of chronically affected birds do not recover from the disease.\"

Lifecycle Stages
The Commonwealth of Australia (2004) reports that, \"Natural infection most likely occurs following ingestion or inhalation of BFDV in the nest hollow from infected faeces or feather dust from the parents. The virus is excreted in the faeces of diseased birds (Wylie and Pass, 1987; Ritchie *et al.* 1991; Raidal *et al.* 1993b). Feather dust may contain as many as one trillion virus particles per millilitre (Ritchie, 1995). Virus particles can also be recovered from crop washings from infected birds (Ritchie *et al.* 1991). Inhalation and ingestion of BFDV can also potentially occur at feeding, roosting and watering points in flocking birds.\"

Habitat Description
Todd (2000) reports that, \"BFDV has been experimentally reproduced in a number of psittacine species including Budgerigars, Galahs, Umbrella Cockatoos and African grey parrots by inoculation of homogenates of feather material or purified virus preparations (Gerlach, 1994).\"
Rahaus and Wolff (2003) indicate that although BFD is known to infect birds from the order Psittaciformes, non-psittacine birds such as those belonging to the genus *Gracula* have tested positive for the presence of BFDV DNA using PCR.

Reproduction
Todd (2004) reports that, \"Although the presence of large amounts of BFDV in affected feather material, faeces and crop washings make it likely that most infections result from oral transmission, there has been some evidence suggesting that vertical (egg) transmission also occurs.\"
The Commonwealth of Australia (2004) reports that, \"BFDV can be detected in the blood by DNA probe as soon as two days after natural exposure. The minimum incubation period for the appearance of dystrophic feathers in experimental infections is 21-25 days (Ritchie, 1995). Birds that become infected after feather development has finished may not develop obvious clinical signs until their next molt six or more months later. The maximum incubation period can be years (Ritchie, 1995). Clarification of the range of the incubation period is desirable to make decisions on length of quarantine.\" The authors also state that, \"Experimental transmission has been achieved through oral, intra-cloacal, subcutaneous, intraocular and intranasal routes (Ritchie *et al.* 1992; Wylie and Pass, 1987). Vertical transmission (from parents to young prior to birth) has been reported on only one occasion with artificially incubated chicks from an infected hen developing disease (Ritchie, 1995).\"

General Impacts
BFDV is not only the most commonly recognised viral disease of wild psittacine birds, especially in Australia but is a problem globally wherever captive psittacine birds are bred (Raidal, 2004)
Clinical signs of this disease are characterised by feather loss and replacement of this lost plumage by deformed feathers. Baldness can also occur when the feather follicles become inactive. Deformities of the beak and claws can also occur. Birds infected by the virus can live for many years though the condition lasts for several months to a year. The birds usually succumb to secondary infections from secondary bacterial, chlamydial or fungal pathogens. .\"
Raidal (2004) reports that, \"Secondary disease problems commonly exist in association with BFDV. These include bacterial, fungal and viral infections. Most birds with chronic disease eventually have difficulty eating, lose weight and die. Acutely affected birds often have mucoid or green diarrhoea. These signs are often clinically diagnosed as secondary bacterial or chlamydial infections. However, the virus can cause acute hepatitis, particularly in cockatoos. Some birds may die of acute hepatitis without obvious feather lesions.\"
Todd (2000) reports that experimentation on BFDV, \"Has revealed that its ability to agglutinate erythrocytes was unaffected by incubation at 80°C for 30 min (Raidal & Cross, 1994a), suggesting that this virus is also very stable. It is likely that circoviruses are extremely resistant to environmental degradation, which, in turn, has implications for virus epidemiology and disease control.\"
Heath *et al.* (2004) states that, \"With the constant movement of birds across geographical borders through trade, there is an increasing risk of spreading the disease into new areas and populations. Coupled to this is the risk of generating unique viruses through recombination between established virus populations and newly introduced viruses.\"
Gill (2001) states that, \"BFDV can devastate breeding programs and cause masked distress to new bird owners and their young birds.”

Management Info
Preventative measures: A killed-virus vaccine has been developed which stimulates immunity to the BFDV in normal healthy birds. Pet birds can be vaccinated when they are as young as 14 days old. There is a requirement of a booster dose a month after the first vaccination. Breeding birds can be vaccinated a month before breeding. After this pet birds should be examined every six months until they are 3 years of age (Raidal, 2004).
Rahaus and Wolff (2003) suggest that, \"In order to stem the spread of BFDV inside captive bird populations, an improved combination of monitoring and quarantine seems to be necessary... Additionally, this monitoring could help in detecting birds in the viral incubation phase.\" Todd (2000) states that, \"Captive birds can be kept free from infection by restricting their exposure to infected birds or virus-contaminated environments such as cages.\"
The Commonwealth of Australia (2004) states that, \"BFDV is difficult to inactivate and is likely to persist in the environment for years, so the underpinnings of control in threatened species are effective diagnosis, monitoring, quarantine and vaccination. Disinfection of nest boxes when disease already exists is another important aspect of control, at least until a suitable vaccine is available. Identifying and managing the environmental factors that predispose to the development of disease may also assist in controlling the threat of this disease. Quarantine periods exceeding six months may be required, with diagnostic tests being carried out at 90 day intervals.\"

Pathway
The genetic diversity of the global virus population, compounded by the difficulties in effectively curbing illegal trade in wild-caught birds, has serious implications for the control of BFDV in southern Africa (Heath *et al.* 2004).

Principal source: Todd, 2000. Circoviruses: Immunosuppressive threats to avian species: A review.
Raidal, 2004. Psittacine beak and feather disease.

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Review: Shane Raidal BVSc PhD FACVSc Senior Lecturer in Veterinary Pathology. School of Veterinary and Biomedical Sciences Murdoch University, Perth Australia

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ALIEN RANGE

[1] AFRICA
[1] INDONESIA
[2] NORFOLK ISLAND
[1] SOLOMON ISLANDS
[1] SOUTH AMERICA
[1] UNITED KINGDOM
[1] GERMANY
[1] NEW ZEALAND
[1] PHILIPPINES
[1] SOUTH AFRICA
[1] THAILAND

Red List assessed species 1: EN = 1;

Lathamus discolor **EN**

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