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Barry K. Hartup

International Crane Foundation

Holly S. Sellers

Poultry Diagnostic Research Center, College of Veterinary Medicine, University of Georgia

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SEROLOGICAL SURVEY FOR INFECTIOUS BURSAL DISEASE VIRUS EXPOSURE IN CAPTIVE CRANES

BARRY K. HARTUP, International Crane Foundation, E-11376 Shady Lane Road, Baraboo, WI 53913, USA

HOLLY S. SELLERS, Poultry Diagnostic Research Center, College of Veterinary Medicine, University of Georgia, Athens, GA 30602, USA

Abstract: Between September 2001 and March 2002, unusually high morbidity and mortality was observed during releases of endangered, captive-reared whooping cranes (*Grus americana*) in central Florida. An ongoing epidemiological investigation has implicated infectious bursal disease virus (IBDV; Family Birnaviridae) as the likely etiological agent (Spalding et al. 2008). The source of this virus remains unknown. A previous serological survey showed positive antibody titers to IBDV serotype 2 were present in small numbers of juvenile and adult whooping cranes at the International Crane Foundation (ICF), Baraboo, Wisconsin and the Patuxent Wildlife Research Center, Laurel, Maryland between 1995 and 2003 (Hartup et al. 2004). The purpose of this study was to complete the serological survey of the ICF captive flock by testing the 14 other species of cranes at the facility (including 1 hybrid individual) for IBDV serotype 2 neutralizing antibodies.

We used 393 archived serum samples from annual physical examinations of 104 individuals conducted between 1998 and 2002. Eighteen of the samples were from hatch-year cranes; the remainder were acquired from cranes 1 to 39 yrs of age (mean = 14 yrs). Serum neutralization titers ≥ 32 were considered positive for IBDV exposure (Thayer and Beard 1998).

Twenty-three percent of the cranes tested were seropositive at least once during the study period (titer range 0 – 512). Seropositive individuals were identified from 10 of the 14 species tested (Table 1). One of the 18 hatch-year cranes tested was seropositive. Seropositive status varied across years within individuals with a complete serological history. There was a significant declining trend in annual flock seroprevalence during the study ($\chi^2 = 7.9, P < 0.01$); peak prevalence was 19.5% in 1998 and declined to a low of 1.2% in 2002 (Table 2). Fifty percent (12/24) of the seropositive individuals had a mate that was also seropositive at least once during the study period. There did not appear, however, to be any spatial clusters of seropositive pairs or individuals on the ICF grounds; the housing status of seropositive cranes mirrored the proportions of cranes housed on public display or in an off-exhibit breeding area.

This data suggests that exposure of captive cranes at ICF to IBDV serotype 2 occurred as early as 1998, was common among the species sampled and certain pairs of cranes, showed a diffuse distribution among the housing units, but may have been in decline flock-wide by the end of the survey. The propensity of low titer levels observed in most of the cranes was probably not associated with active infection. None of the cranes, including seropositive individuals, exhibited any of the clinical signs of wasting previously associated with IBDV-related disease in whooping cranes. The results of this study suggest there is potential risk for IBDV serotype 2 introduction with transfer of seropositive cranes to new exhibits or zoos, or habitat used for re-introduction. Screening cranes prior to transfer may be warranted.

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Table 1. Species and numbers of individuals tested and seropositive for IBDV antibodies at ICF, 1998–2002.

Species		No. tested	No. positive
Black crowned crane	<i>Balearica pavonina</i>	3	1
Grey crowned crane	<i>Balearica regulorum</i>	3	2
Blue crane	<i>Anthropoides paradisea</i>	2	0
Demoiselle crane	<i>Anthropoides virgo</i>	2	0
Wattled crane	<i>Bugenerus carunculatus</i>	8	3
Sarus crane	<i>Grus antigone</i>	7	2
Sandhill crane	<i>G. canadensis pratensis</i>	14	4
Eurasian crane	<i>G. grus</i>	2	2
Red-crowned crane	<i>G. japonensis</i>	9	3
Siberian crane	<i>G. leucogeranus</i>	19	1
Hooded crane	<i>G. monacha</i>	8	3
Black-necked crane	<i>G. nigricollis</i>	7	0
Brolga	<i>G. rubicunda</i>	9	0
White-naped crane	<i>G. vipio</i>	10	3
Hybrid	<i>G. canadensis x G. japonensis</i>	1	0

Table 2. Annual flock mean titer and seroprevalence for IBDV antibodies in 14 crane species at ICF, 1998–2002.

Year	No. tested	Mean \pm SE	No. positive	% positive
1998	77	25.6 \pm 7.9	15	19.5
1999	80	13.5 \pm 4.0	8	10
2000	78	17.3 \pm 5.0	12	15.4
2001	77	11.5 \pm 2.6	11	14.3
2002	81	3.2 \pm 0.8	1	1.2