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SOMER HARTMAN
International Crane Foundation

BETSY REICHENBERG
International Crane Foundation

JANE FANKE
Leibniz Institute for Zoo and Wildlife Research

ANNE E. LACY
International Crane Foundation

BARRY K. HARTUP
International Crane Foundation

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SOMER HARTMAN, International Crane Foundation, E-11376 Shady Lane Road, Baraboo, WI 53913, USA
BETSY REICHENBERG, International Crane Foundation, E-11376 Shady Lane Road, Baraboo, WI 53913, USA
JANE FANKE, Leibniz Institute for Zoo and Wildlife Research, Department for Wildlife Diseases, Alfred-Kowalke-Strasse 17, 10315 Berlin, Germany
ANNE E. LACY, International Crane Foundation, E-11376 Shady Lane Road, Baraboo, WI 53913, USA
BARRY K. HARTUP, International Crane Foundation, E-11376 Shady Lane Road, Baraboo, WI 53913, USA

Windingstad and Trainer (1977) used both fecal sampling and postmortem examinations to document the occurrence of parasites in greater sandhill cranes (*Grus canadensis tabida*) from Wisconsin in the fall. We conducted repeated fecal sampling of a well-known population to expand on results of their study. Our objective was to determine whether seasonal differences exist in the prevalence of endoparasites of Wisconsin sandhill cranes.

We collected 7 to 10 fecal samples approximately every other week from a consistent roost site on the Wisconsin River (43°34′52.99″N, 89°36′38.42″W) near Briggsville, Wisconsin, from 29 May through 25 September 2008. The sample size was based on the assumption that endoparasite prevalence in this population was high: a single positive result would allow us to be 99% certain that the parasite was prevalent in 50% or greater of the crane population (Martin et al. 1987). Each anonymously collected fecal sample consisted of a single, fresh mass. Samples were collected into plastic bags and kept refrigerated until analysis (2-24 hours later). Three methods were used to detect parasites: a standard direct smear of feces in saline, fecal flotation in sodium nitrate solution (Ovatector, BGS Medical Products, Inc, Venice, FL.) (Greiner 1997), and examination of the uppermost layer of sediment 10 minutes following mixing of the sample with sodium nitrate. All parasitic ova were identified based on morphological criteria and reference keys to parasites of birds (Courtney et al. 1975, Greiner 1997, Forrester and Spalding 2003). The prevalence of all parasites was summarized by month

Table 1. Parasites found in fecal samples of greater sandhill cranes (*Grus canadensis tabida*) in south-central Wisconsin, 2008.

	June[a] *n* = 27	July *n* = 21	August *n* = 24	September *n* = 17	Total *n* = 89
Protozoa					
Eimeria gruis	24 (89)[b]	18 (86)	22 (92)	17 (100)	81 (91)
Eimeria reichenowi	23 (85)	20 (95)	19 (79)	11 (65)	73 (82)
Helminths					
Trematoda					
Unidentified ova	20 (74)	16 (76)	21 (88)	16 (94)	73 (82)
Nematoda					
Capillaria sp.	7 (26)	6 (29)	4 (17)	5 (29)	22 (25)
Spirurid ova	5 (18)	1 (5)	0 (0)	0 (0)	6 (7)
Strongyloid ova	1 (4)	1 (5)	0 (0)	1 (6)	3 (3)
Gapeworms[c]	1 (4)	2 (10)	3 (12)	0 (0)	6 (7)
Unidentified larvae/ova	5 (18)	6 (29)	4 (17)	2 (12)	17 (19)
Cestoda					
Unidentified segments	0 (0)	1 (5)	1 (4)	0 (0)	2 (2)

[a] 29 May sample results combined with results from June.
[b] No. positive (%).
[c] Similar to *Syngamus* sp. or *Cyathostom*a sp. (genera of specimens unidentified).

to identify trends in fecal shedding. The number of coccidian oocysts was estimated using the flotation method and counting all oocysts in a single randomly chosen line of view across the 22 × 22 mm coverslip while viewing at 200x (1 line of 22 potential lines of view), and then multiplying by 22. The mean number of coccidian oocysts among positive samples was also calculated at each collection date to provide a quantitative estimate of shedding among infected cranes.

A total of 89 fecal samples from 10 sampling dates were collected and examined. The median number of roosting cranes counted the evening prior to the sample collection dates was 96 (range 39-270). Coccidian parasites were observed in 86 (97%) fecal samples and in each month during the study (Table 1). Trematodes were observed in 73 (82%) fecal samples and nematodes in 42 (47%). We identified 2 species of coccidian parasites and 3 genera of nematodes from the samples, but we lacked adult specimens to correctly identify several parasites to the genus level. Both ova and larval nematodes were observed, as were 2 unidentified cestode segments, and unidentified trematode ova (similar to *Orchipedum* sp. or *Strigea* sp). We observed the greatest variety of taxa in fecal samples collected during July.

Eimeria gruis oocysts were observed in 81 (91%) and *E. reichenowi* oocysts were observed in 73 (82%) of the fecal samples examined. We observed polymorphism among *E. reichenowi*-type oocysts, similar to the findings of Courtney et al. (1975), Windingstad and Trainer (1977), and Parker and Duszynski (1986). The number of both *E. gruis* (range 1-13,662) and *E. reichenowi* (range 1-9,658) oocysts in positive fecal samples increased throughout late spring and early summer (Fig. 1). In comparison to other studies of endoparasite burden in greater sandhill cranes, we found a differential seasonal pattern of shedding and possible transmission among *Eimeria* species. *Eimeria gruis* oocysts increased markedly in July, peaking at the start of August before declining steadily to lower levels in September, while the number of *E. reichenowi* oocysts declined in fecal samples by mid-July to levels similar in spring that remained throughout late summer and fall.

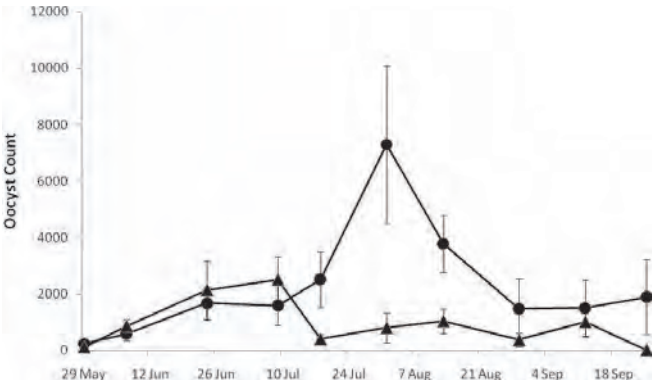

Figure 1. Estimated mean (±SE) counts of *Eimeria gruis* (●) and *E. reichenowi* (▲) oocysts from fecal samples of greater sandhill cranes collected in south-central Wisconsin, 2008.

Both *E. gruis* and *E. reichenowi* are commonly found in wild populations of sandhill cranes (Courtney et al. 1975, Forrester et al. 1976, Windingstad and Trainer 1977, Parker and Duszynski 1986), and are a recognized cause of disseminated visceral coccidiosis (DVC) (Carpenter et al. 1984). Experimental infections with a mixture of 20,000 sporulated *E. gruis* and *E. reichenowi* oocysts caused extensive lesions and death in 28 day-old greater sandhill crane chicks (Carpenter et al. 1984). The maximum number of oocysts we observed in the fecal samples approached this level during peak shedding. Temporal peaks in shedding likely facilitate transmission, but may also increase risk of disease in susceptible hosts, especially in young cranes. We suspect most of the cranes sampled in our study had a degree of immunity to the pathological effects of coccidian parasites. To date, we have no confirmed reports of DVC in cranes of any age from south-central Wisconsin (International Crane Foundation and Wisconsin Department of Natural Resources, unpublished data).

Our study shows that parasitism of greater sandhill cranes on the summering grounds is common. Windingstad and Trainer (1977) found comparable occurrence of *E. gruis*, *E. reichenowi*, and *Capillaria* sp. in their study of cranes in Wisconsin and Indiana during fall months. Our findings are also generally comparable to the findings of Forrester et al. (1976) which were based on fecal and postmortem samples from wintering greater sandhill cranes in Florida. We attribute many of the differences to the limits of fecal analysis for parasite detection compared to full investigation of the gastrointestinal tract using

postmortem samples. For example, we failed to observe *Tetrameres grusi* by fecal examination, a parasite frequently recovered from postmortem analyses.

The significance of helminth parasites for the study population is unclear. *Capillaria* has been shown to be pathogenic in captive-reared Mississippi sandhill cranes (*G. canadensis pulla*) following reintroduction to the wild (Carpenter and Derrickson 1987). Deaths associated with gapeworm infections have also been described in captive sandhill cranes (Carpenter et al. 1976). Asphyxiation caused by gapeworms was previously documented in a chemically immobilized juvenile greater sandhill crane from our study area. There is little known about the morbidity attributable to helminth parasites in wild greater sandhill cranes, but it is likely not significant since few deaths have been attributed to them.

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