

## Parasites of Greater Sandhill Cranes (*Grus canadensis tabida*) on Their Wintering Grounds in Florida<sup>1</sup>

DONALD J. FORRESTER,<sup>2</sup> ALBERT O. BUSH,<sup>2</sup> LOVETT E. WILLIAMS, JR.,<sup>3</sup> AND DAVID J. WEINER<sup>2</sup>

**ABSTRACT:** Twenty-two species of parasites were recovered from 74 greater sandhill cranes (*Grus canadensis tabida*) from four localities in Florida during 1970–73. These included three species of coccidia, one haemosporida, five trematodes, nine nematodes, and four biting lice. Twenty are new host records. Quantitative data are given only for helminth infections. The most common helminths were *Orchipedium jolliei*, *Strongyloides* sp., and *Tetrameres grusi*. Measurements of specimens of *O. jolliei* were smaller for flukes from multiple infections, indicating a possible “crowding effect.” The numbers of helminth species per infected host averaged three (range, 1–4) with only one crane free of helminths. The total number of helminths per infected bird averaged 39 (range, 1–292). The most heavily parasitized organs were the small intestine and the proventriculus.

There are six subspecies of the sandhill crane (*Grus canadensis*) all of which occur only in the Western Hemisphere. Two of these, the greater sandhill crane (*G. c. tabida*) and the Florida sandhill crane (*G. c. pratensis*), occur in Florida (Fisher et al., 1969). Cranes that breed in Florida are *G. c. pratensis*, whereas the northern migrants, which mingle with the resident populations during the winter, are *G. c. tabida* (Williams and Phillips, 1972). Both birds are listed as rare on the U. S. Fish and Wildlife Service’s “rare and endangered species” list (Committee on Rare and Endangered Fish and Wildlife of the United States, 1966).

The present report is based on the coccidia, haemosporida, helminths, and mallophagans collected from greater sandhill cranes obtained from four localities in Florida.

Existing records of parasites from greater sandhill cranes include one trematode (*Brachylecithum gruis* Denton and Byrd, 1951) and two biting lice [*Esthiopterum brevicephalum* (McGregor, 1917) and *Gruimenopon canadense* Edwards, 1949].

### Materials and Methods

From February 1970 through February 1973, 74 sandhill cranes were examined for parasites. The birds were from wintering

flocks on: (1) Paynes Prairie, Alachua County (46 birds), (2) Juniper Prairie, Lake County (1 bird), (3) Lake X, Osceola County (2 birds), and (4) KD Ranch, Highlands County (25 birds). All were yearlings or older individuals from populations known to be predominantly greater sandhill cranes.

Thirty-four of the birds were obtained as a result of mortality due to trapping operations being conducted by the Florida Game and Fresh Water Fish Commission (Williams and Phillips, 1973) and were examined at necropsy. Some were examined within a few hours after death, but most were frozen and examined later. Procedures for recovery, killing, fixing, and studying helminths were similar to those described by Kinsella and Forrester (1972).

Blood samples were obtained from 51 cranes, five of which were from the 34 birds examined at necropsy, and 46 were from birds captured and later released alive. Films were made with blood taken from a wing vein and stained with Giemsa’s stain. To detect blood protozoans approximately 30,000 red blood cells were examined on each slide using oil immersion (1,000×).

Fecal samples were obtained from 46 cranes, 16 of which were from birds examined at necropsy. The remaining 30 were from live-trapped birds which were later released. These samples were placed in 2% potassium dichromate solution and later examined for coccidian oocysts using standard flotation techniques.

Ectoparasites were collected with forceps or a fine-tipped brush, killed, fixed, and preserved in 70% ethyl alcohol, and later cleared and mounted following standard techniques.

<sup>1</sup> Supported in part by Research Grants No. 977-G and 1270 from the Florida Game and Fresh Water Fish Commission’s Federal Aid to Wildlife Restoration Program, Florida Pittman–Robertson Project W-41. Florida Agricultural Experiment Stations Journal Series No. 4962.

<sup>2</sup> University of Florida, Veterinary Science, IFAS, Gainesville, Florida 32611.

<sup>3</sup> Game and Fresh Water Fish Commission, Wildlife Research Projects Office, Gainesville, Florida 32601.

**Table 1.** Helminths of 34 greater sandhill cranes collected in Florida from February 1970 to February 1973.

Helminth	No. birds infected	No. worms/infection	
		Mean	(Range)
<b>Trematoda</b>			
<i>Orchipeidum jollicii</i> (8, 9)*	19	7	(1-28)
<i>Brachylaima fuscatum</i> (4)	5	3	(1-5)
<i>Strigea gruis</i> (3,4)	2	15	(11-19)
<i>Prosthogonimus macrorchis</i> (6)	1	1	-
Echinostomidae (5)	1	1	-
<b>Nematoda</b>			
<i>Tetrameres grusi</i> (1)	23	22	(1-79)
<i>Strongyloides</i> sp. (3, 4, 5)	17	31	(1-188)
Spiruroid larvae† (1, 2)	10	11	(1-31)
<i>Syngamus trachea</i> (8)	7	3	(1-4)
<i>Trichostrongylus tenuis</i> (3)	1	6	-
<i>Dispharynx nasuta</i> (1)	1	2	-
<i>Synhimantus</i> sp. (2)	1	1	-
<i>Amidostomum</i> sp. (2)	1	1	-
<i>Capillaria</i> sp. (4)	1	1	-
<i>Chandlerella</i> sp. (7)	1	1	-

\* Numbers in parentheses indicate location in host: (1) proventriculus, (2) under gizzard lining, (3) duodenum, (4) lower small intestine, (5) ceca, (6) cloaca, (7) heart, (8) trachea, (9) lungs.

† Probably larvae of *Tetrameres grusi*.

## Results and Discussion

Twenty-two species of parasites were recovered including three coccidia, one haemosporida, five trematodes, nine nematodes, and four biting lice. All except two are new host records.

### Protozoa

Of the 51 blood films examined, four contained light infections of a species of *Haemoproteus*. This species, morphologically similar to *H. antigone* de Mello, 1935, is being studied further. Representative blood films have been deposited in the collection of the WHO International Reference Centre for Avian Malaria Parasites at Memorial University of Newfoundland, St. John's, Newfoundland, Canada.

Oocysts of three undescribed species of *Eimeria* were found commonly in feces from cranes collected in all localities. These will be described and discussed further elsewhere.

### Helminths

Table 1 gives: (1) the species of helminths encountered, (2) the site of infection for each helminth, (3) the number of hosts infected with each helminth, and (4) mean numbers

**Table 2.** Numbers of species, prevalence of infection, and burdens of helminths in organs of 34 greater sandhill cranes from Florida.

Organ	No. birds infected	Total no. helminth species	No. helminths	
			Mean	(Range)
Small intestine	28	5	17	(1-167)
Proventriculus	23	2	15	(1-79)
Trachea	24	2	4	(1-27)
Gizzard	9	3	3	(1-31)
Lungs	3	1	1	-
Ceca	1	1	1	-
Cloaca	1	1	1	-
Heart	1	1	1	-
All organs	-	14	39	(1-292)

(and ranges) of worms per infection. The number of helminth species per infected host varied from 1 to 4 (mean, 3) with only one crane free of helminths. The total number of helminths per infected bird ranged from 1 to 292 (mean, 39). The small intestine was the most heavily parasitized organ and contained an average of 17 parasites (representing five species) per bird. Within the small intestine the most heavily parasitized section was the lower small intestine which contained an average of nine worms (of four species) per bird compared to the duodenum which contained only six worms (of three species) per bird. The second most heavily parasitized organ was the proventriculus which averaged 15 parasites per bird. The majority of the parasites in the proventriculus were *Tetrameres grusi* Shumakovitch, 1946. Additional information on the numbers of species and burdens in each organ is presented in Table 2.

### Trematoda

The most common trematode encountered was *Orchipeidum jollicii* which was described by Schell (1967) on the basis of one specimen from the trachea of a lesser sandhill crane, *G. c. canadensis*, from Idaho. It has been found again in one of 12 lesser sandhill cranes in West Texas (Burnham, 1972). Ours is the first report of this fluke in greater sandhill cranes. In Table 3 measurements are given for 20 specimens and these are compared to measurements of the type specimen of Schell (1967). Measurements are also given in Table 3 of specimens from infections in which only one or two worms were found in comparison to in-

Table 3. Comparative measurements of *Orchepedum jolliei* from greater sandhill cranes in Florida.

Measurement*	Schell's (1967) specimen	Specimens from present study					
		Infections with 1 or 2 worms/host		Infections with 8-28 worms/host		All specimens	
		Mean	(Range)	Mean	(Range)	Mean	(Range)
Body length (mm)	19.0	21.4	(16.0-24.3)	18.7	(16.2-21.1)	19.7	(16.0-24.3)
Body width (mm)	2.7	2.7	(2.4-3.1)	2.3	(1.8-2.7)	2.5	(1.8-3.1)
Length of oral sucker (mm)	1.2	1.2	(1.1-1.2)	1.0	(0.9-1.1)	1.1	(0.9-1.2)
Width of oral sucker (mm)	1.4	1.3	(1.2-1.4)	1.2	(1.0-1.3)	1.2	(1.0-1.4)
Diameter of ventral sucker (mm)	1.6	1.6	(1.5-1.7)	1.4	(1.1-1.6)	1.5	(1.1-1.7)
Length of pharynx	733	682	(644-714)	649	(532-700)	662	(532-714)
Width of pharynx	530	588	(546-630)	520	(434-574)	547	(434-630)
Number of testes	300	306	(235-400)	310	(235-425)	309	(235-425)
Length of ovary	764	597	(448-728)	519	(350-644)	550	(350-728)
Width of ovary	514	494	(406-574)	394	(210-462)	434	(210-574)
Egg length	92	74	(62-90)	72	(65-85)	73	(62-90)
Egg width	61	46	(39-55)	45	(37-57)	46	(37-57)
Transverse ridge length (mm)	—	9.7	(5.0-11.2)	9.4	(7.5-11.1)	9.5	(5.0-11.2)
% transverse ridges	33	45	(31-51)	51	(44-56)	48	(31-56)
No. specimens measured	1	8		12		20	

\* Measurements are in microns unless otherwise indicated.

fections with eight to 28 worms per host. In all cases flukes from multiple infections were smaller, indicating a possible "crowding effect."

In some infections *Orchepedum* was associated with an excess of mucus and some inflammation was seen in the trachea near the site of worm attachment.

*Brachylaima fuscatum* (Rudolphi, 1819) is a common trematode of birds which has been reported from a variety of passeriform and galliform birds (Yamaguti, 1971). This is the first report from a gruiform.

*Strigea gruis* was described by Dubois and Rausch (1964) from specimens obtained from three lesser sandhill cranes in Alaska. It has not been reported from any other host.

The presence of *Prosthogonimus macrorchis* Macy, 1934, is unexplained, particularly since other hosts [Florida ducks, *Anas platyrhynchos fulvigula* (Kinsella and Forrester, 1972) and wild turkeys, *Meleagris gallopavo osceola* (Hon, 1973)] in the same regions are infected with *P. ovatus* (Rudolphi, 1803).

A single specimen of the family Echinostomidae, morphologically similar to *Echinostoma*, was recovered from the cecum of one crane. Further identification was not possible since the specimen was obtained from a bird that had been frozen and the collar spines were missing.

## Nematoda

The most common nematode was *Tetrameres grusi*, originally described on the basis of five

male specimens taken from the gray crane (*Grus grus*) in western Siberia (Shumakovich, 1946). This species in sandhill cranes has been discussed in another paper (Bush, Pence, and Forrester, 1973) in which the male was redescribed and the female described for the first time. This represents the first report of this species from North America. Burnham (1972) reported infections of an unidentified species of *Tropisurus* in 20 of 57 lesser sandhill cranes in Texas, which may have been *T. grusi*. In the present study spirurid larvae, probably of *T. grusi*, were found in the proventriculus and under the gizzard lining of 10 cranes.

The second most common nematode, *Strongyloides* sp., was found in 17 cranes and apparently represents an undescribed species. Parasitic females were 2.50-3.25 mm (mean, 2.87 mm) in total length and contained up to six eggs (mean, three eggs). Esophagus length was 615-840  $\mu$  (mean, 708  $\mu$ ). Free-living males and females were cultured from crane feces. Males were 588-868  $\mu$  (751  $\mu$ ) in total length with spicules 34-40  $\mu$  (37  $\mu$ ) and esophagus 85-135  $\mu$  (115  $\mu$ ) in length. Free-living females were 1.11-1.19 mm (1.15 mm) long with esophagus 165-175  $\mu$  (170  $\mu$ ) in length. Measurements of free-living males and parasitic females were close to those published by Cram (1929) for *S. avium* from chickens but free-living females of the species of *Strongyloides* from cranes were considerably larger than those of *S. avium*.

*Syngamus trachea* (Montagu, 1811) was the third most prevalent nematode, but occurred in small numbers. This cosmopolitan species is fairly common in Galliformes and Passeriformes and has been reported from six other orders of birds (Yamaguti, 1961). This is the first report of it in a gruiform.

One male specimen of an undescribed species of *Synhimantus* was recovered from a crane from the KD Ranch in south Florida. The same species has been recovered also from wild turkeys and white ibis, *Eudocimus albus*, from Florida (Hon, 1973; Bush, 1973). The specimen was 5.2 mm long, the long spicule was 628  $\mu$ , the short spicule was 148  $\mu$ , and the cordons extended posteriorly 112  $\mu$  from the anterior end.

The remaining six nematodes were each represented by a single infection and all are probably abnormal parasites for this host. Two, *Trichostrongylus tenuis* (Mehlis, 1846) and *Dispharynx nasuta* (Rudolphi, 1819), are common in other hosts collected in the same general areas (Hon, 1973). These two species have wide host ranges and may represent seasonally abnormal parasites which occur in relative paucity in cranes on their wintering grounds.

*Amidostomum* sp., *Capillaria* sp., and *Chandlerella* sp. were each represented by a single individual and for this reason specific determinations were not made.

### Mallophaga

Four species of biting lice were found: *Esthiopterum brevicephalum*, *Gruimenopon canadense*, *Saemundssonina sagulata* Timmermann, 1971, and *Heleonomus assimilis* (Pioget, 1880). *Esthiopterum brevicephalum* has been reported from greater sandhill cranes in Minnesota (McGregor, 1917) and *G. canadense* from lesser sandhill cranes in Alaska and Texas (Edwards, 1949) and greater sandhill cranes in Indiana (Carriker, 1958). *Saemundssonina sagulata* has been reported only from *Grus c. pratensis* which is its type host (Timmermann, 1971). This is the first report of *H. assimilis* from the greater sandhill crane, however, which was previously known only from the whooping crane, *Grus americana* (Emerson, 1964).

### Acknowledgments

We wish to thank R. W. Phillips, T. E. Peoples, D. H. Austin, S. A. Nesbitt, R. L. McClellon, L. H. Barwick, and J. A. Brown for assistance in obtaining specimens. We also appreciate the advice and assistance in identifications and taxonomic problems provided by Drs. J. M. Kinsella, R. C. Anderson, G. Dubois, J. V. Ernst, G. F. Bennett, and K. C. Emerson. The technical assistance of C. R. Beal, P. P. Humphrey, and M. V. Barney is gratefully acknowledged.

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## The Influence of Intermediate Hosts on the Infection Pattern of *Protospirura numidica criceticola* Quentin, Karimi, and Rodriguez De Almeida, 1968 (Nematoda: Spiruridae) in the Bonneville Basin, Utah

MARK C. HEALEY<sup>1</sup> AND ALBERT W. GRUNDMANN

Department of Biology, University of Utah, Salt Lake City, Utah

**ABSTRACT:** The infection pattern of *Protospirura numidica criceticola* Quentin, Karimi, and Rodriguez De Almeida, in the Bonneville Basin, Utah, is reported. The white-footed deer mouse, *Peromyscus maniculatus sonoriensis* (LeConte), was selected as the experimental host because it is a natural host in this region. Incidence of infection in the desert habitats was highest during late summer and autumn but declined in early winter becoming low by spring. Mountain habitats showed a much lower uniform yearly infection rate. Three new insect intermediate hosts were revealed. These include the grasshoppers, *Melanoplus femur-rubrum* (DeGeer) and *M. atlanis* (Riley), and the cricket, *Gryllus pennsylvanicus* (Burm.). A darkling beetle, *Eleodes tuberculata patruelis* Blaisdell, was the only proved insect host previously known from this area. Nematode eggs were viable in excess of 3 years. Larval development at 25 C occurred at different rates in different species of insects. Infectivity of encysted juveniles in *E. t. patruelis* did not decrease up to 170 days postinfection. Newly hatched larvae entered a quiescent state in the hemocoel of this beetle at 5 C but later resumed normal development at 25 C. Deer mice harbored adult worms in the stomach and lower esophagus up to 130 days postinfection.

*Protospirura numidica criceticola* is widespread, occurring in all major habitats from vegetated dunes of the Great Salt Lake Desert at 4,200 ft to alpine tundra at 11,500 ft. In the Bonneville Basin of western Utah at least seven rodent species are parasitized. They in-

clude the common deer mice, *Peromyscus maniculatus sonoriensis* (LeConte) and *P. m. rufinus* (Merriam), pinion mouse, *P. truei nevadensis* Hall and Hoffmeister, canyon mouse, *P. crinitus pergracilis* Goldman, western harvest mouse, *Reithrodontomys megalotis megalotis* (Baird), grasshopper mouse, *Onychomys leucogaster utahensis* Goldman, least chipmunk, *Eutamias minimus pictus* (Allen),

<sup>1</sup> Present address: Department of Veterinary Microbiology, Pathology and Public Health, School of Veterinary Science and Medicine, Purdue University, Lafayette, Indiana 47907.