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HELMINTH FAUNA OF SANDHILL CRANE POPULATIONS IN TEXAS

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ABSTRACT: Three species of trematode [*Orchipedium jolliei* Schell, 1967; *Prohyptiamus grusi* Kocan, Waldrup, Ramakka, and Iverson, 1982; *Echinostoma revolutum* (Froelich, 1802)], three species of nematode (*Tetrameres grusi* Shumakovich, 1946; *Synhimanthus* sp.; *Contracaecum* sp.), and one species of cestode (*Anomotaenia* sp.) were recovered from 146 sandhill cranes, *Grus canadensis* (Linnaeus), collected in Alaska, Canada, and two areas in Texas. The only common and abundant species were *O. jolliei* and *T. grusi*. Of cranes collected in Texas, those that came from the Canadian breeding grounds had significantly greater abundances of *O. jolliei* and *T. grusi* than those from Alaska. However, cluster analysis using rank abundances of helminth species across the four geographic regions and stepwise multiple discriminant analysis using the grouping variable of the presence or absence of a subspecies-specific pancreatic protein indicated that classification of cranes into populations based on helminth abundances was impractical as a management technique.

INTRODUCTION

The migratory populations of sandhill cranes breed over an extensive range from northeastern Siberia to Michigan in the United States (Lewis, 1977). The three recognized subspecies breeding across this range are the lesser sandhill crane (*G. canadensis canadensis*), the Canadian sandhill crane (*G. canadensis rowani*), and the greater sandhill crane (*G. canadensis tabida*) (Lewis, 1977).

Since 1961 when hunting was authorized on sandhill cranes in Texas, there has been concern over its effects on breeding populations (Buller, 1967; Miller et al., 1972; Lewis, 1977). Breeding populations must be defined so that data on numbers and annual production can be used to establish proper hunting regulations (Geis et al., 1969).

Previous studies (Burnham, 1972; Bush et al., 1973; Forrester et al., 1974, 1975; Iverson et al., 1983) have documented the helminth fauna of sandhill cranes in North America. Differences in the composition of the helminth fauna and the variance in helminth prevalences have been suggested as possible indicators for separating geographic variants (subspecies populations) of this host (Forrester et al., 1976; Iverson et al., 1983). The faunal composition and abundances of the respective helminth species may vary across this host's breeding and wintering range due to many factors, but especially as a result of environmental differences across the geographic range. Thus, the objectives of this study were to (1) delineate the helminth fauna of sandhill cranes in Alaska, Canada, and Texas and (2) determine if abundances of the respective helminth species vary significantly between different breeding populations of sandhill cranes wintering in Texas.

MATERIALS AND METHODS

Twenty-one sandhill cranes were collected from the breeding range in Alaska and Canada to serve as allopatric controls (Gaines and Warren, 1984). Seven cranes collected from Delta Junction, Alaska in September 1982 represented the population of *G. canadensis canadensis*. Fourteen cranes collected near Kutawagan Lake, Saskatchewan, Canada in June 1982 represented the population of *G. canadensis rowani*. Specimens of *G. canadensis tabida* from their breeding range were not collected because of their low numbers overwintering in Texas and budget restraints.

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One hundred twenty-five sandhill cranes were collected on their wintering grounds in Texas from November 1982 to January 1983. Eighty-nine were collected from the Texas Panhandle in Lamb County near Bull Lake. Thirty-six were collected from southern Texas in Colorado County on the Attwater Prairie Chicken National Wildlife Refuge.

Cranes were collected by shooting. Age was determined by the presence or absence of a feathered crown and brown feathers on the nape of the neck (Walkinshaw, 1949). Sex was determined by gonad examination. The viscera were collected and frozen for later necropsy. The body cavity was examined visually for helminths at the time of evisceration. Recovery of helminths was facilitated by washing and sedimentation using conical glasses. Both the supernatent and sediment were examined for helminths in an attempt to obtain total recovery of all specimens.

Nematodes were fixed in acetic acid, stored in a mixture of 70% ethanol and 5% glycerin, and examined as temporary wet mounts in glycerin. Trematodes and cestodes were fixed in alcohol-formalin-acetic acid and stored in 70% ethanol. Trematodes and cestodes were stained in Semicohn's acetic carmin and celestine blue B, respectively, and mounted in Canada balsam. Representative specimens of helminths recovered in this study have been deposited in the U.S. National Parasite Collection, Beltsville, Maryland 20705, USA (Accession Nos. 77997–78000).

Using electrophoresis, a discrete genetic difference in a protein from the pancreas was detected between breeding populations of sandhill cranes. The protein, designated P1, was present in Canadian but absent in Alaskan cranes (Gaines and Warren, 1984). This difference was used to classify the origin of cranes collected in Texas.

Abundance data for each helminth species were independently rank transformed (Conover and Iman, 1981) prior to subsequent analysis using SAS (Ray, 1982). Cluster analysis across the average rank abundances of all helminth species and for the two most common species from each of the four geographic localities was used in an attempt to sort the crane populations based on breeding/wintering grounds. The measure was the product-moment correlation coefficient and the algorithm was average linkage. The program was executed using BMDP (Dixon, 1981).

Crane populations in Texas, based on the P1 pancreatic protein, were used as major groupings for stepwise multiple discriminant analysis across rank abundances of the two common helminth species (Dixon, 1981). This analysis determined the number of correctly classified samples placed within a population and the significant helminth discriminators between host populations.

A one-way, two-tailed analysis of variance (Dixon, 1981) determined significant differences of ranked helminth abundances between (1) different geographic regions in North America and (2) different crane populations in Texas based on the presence or absence of the P1 pancreatic protein.

The terms prevalence, intensity, and abundance are according to the definitions of Margolis et al. (1982). Significant or significantly refer to statistical significance at $P \leq 0.05$.

RESULTS AND DISCUSSION

Specimens of three trematode (*Orchipedium jolliei, Prohyptiamus grusi, Echinostoma revolutum*), three nematode (*Tetrameres grusi, Synhimanthus* sp., *Contracaecum* sp.) and one cestode (*Anomotaenia* sp.) species were recovered. Prevalence, intensity, and abundance data for each helminth species by locality are listed in Table 1. The only highly prevalent and abundant species recovered from all regions were *O. jolliei* and *T. grusi* (>30% prevalence across the entire 146-sample dataset). Prevalences of the remaining species were <10% across the 146-sample dataset. *Prohyptiamus grusi* occurred in all regions except Canada, but prevalences and abundances were low in most regions. *Anomotaenia* sp. was recovered only from cranes in Texas. The remaining three species of helminths were recovered only in cranes from a single region. Thus, in most of the following analyses only data on *T. grusi* and *O. jolliei* were considered.

There were significant differences in the rank abundances of both *T. grusi* and *O. jolliei* across cranes from all four geographic regions collectively. Among individual regions, there were significant differences in rank abundances of *T. grusi* in cranes from the Texas Panhandle compared to Canada and from the Texas Panhandle compared to southern Texas. There

TABLE 1. Helminth fauna of sandhill cranes from Alaska, Canada, and two areas in Texas.

Helminth species and location	Prevalence %	Intensity			Abundance	
		$\bar{x}$ ± SE	SD	Range	$\bar{x}$ ± SE	SD
Alaska (n = 7)						
Tetrameres grusi (P)[a]	57	1.3 ± 0.3	0.5	1–2	0.7 ± 0.3	0.8
Orchipedium jolliei (T)	71	11.4 ± 3.5	7.9	5–25	8.1 ± 3.0	7.8
Echinostoma revolutum (S)	29	12.5 ± 11.5	16.2	1–24	3.6 ± 3.1	8.3
Prohyptiamus grusi (B)	14	1.0 ± 0.0	0.0	1	1.0 ± 0.2	0.6
Canada (n = 14)						
Synhimanthus sp. (S)[b]	14	2.5 ± 0.5	0.7	2–3	0.4 ± 0.2	0.9
Tetrameres grusi (P)	57	12.8 ± 3.0	8.5	2–28	7.2 ± 2.3	8.7
Orchipedium jolliei (T)	64	1.7 ± 0.4	1.1	1–4	1.1 ± 0.2	0.6
Texas Panhandle (n = 89)						
Tetrameres grusi (P)	39	4.1 ± 0.8	4.5	1–20	1.6 ± 0.4	3.3
Contracaecum sp. (C)[b]	1	1.0 ± 0.0	0.0	1	0.1 ± 0.7	0.6
Orchipedium jolliei (T)	44	6.9 ± 1.6	9.8	1–50	3.0 ± 0.8	7.2
Prohyptiamus grusi (B)	7	2.3 ± 0.9	2.1	1–6	0.2 ± 0.9	0.8
Anomotaenia sp. (S)[c]	5	1.3 ± 0.3	0.5	1–2	0.6 ± 0.6	0.6
Southern Texas (n = 36)						
Tetrameres grusi (P)	56	24.8 ± 9.0	40.4	1–166	13.8 ± 5.3	31.8
Orchipedium jolliei (T)	81	12.4 ± 2.0	10.6	1–37	10.0 ± 1.8	10.6
Prohyptiamus grusi (B)	17	3.5 ± 1.0	2.4	1–7	0.6 ± 0.2	1.2
Anomotaenia sp. (S)[c]	22	3.5 ± 1.8	5.1	1–16	0.8 ± 0.4	2.5

[a] Letter in parentheses indicates the organ from which the species of helminth was obtained: P—proventriculus; B—body cavity; S—small intestine; C—crop; T—trachea and air sacs.

[b] Could not be identified to species because only larvae or immature specimens were obtained.

[c] Could not be identified to species because of poor condition of specimen.

were significant differences in rank abundances of *O. jolliei* in cranes from Alaska compared to Canada, Alaska compared to the Texas Panhandle, and Canada compared to southern Texas.

There were no significant differences in rank abundances of *O. jolliei* or *T. grusi* between juveniles and adults or between sexes of cranes across the entire population (146-sample dataset).

Cluster analysis was used as a sorting technique for defining similar geographic regions in terms of the rank abundances of species comprising the helminth fauna. Since the rare and uncommon helminths could provide a unique component to the helminth fauna of a particular region, cluster analyses were performed on the rank abundances of all helminth species as well as for only *O. jolliei* and *T. grusi* across the four geographic regions. Results were almost identical. Two important clusters were formed: Cluster One included cranes from Alaska and southern Texas and Cluster Two combined cranes from Canada and the Texas Panhandle.

Our classification of cranes based on the presence or absence of the P1 pancreatic protein is supported by previously published classifications based on morphological characteristics (Lewis, 1977). The P1 protein was present in the cranes collected from Canada but absent in those collected from Alaska (Gaines and Warren, 1984). Of the cranes collected from Texas, the P1 protein was absent in 71%. Of these, 93% were from the Texas Panhandle. The P1 protein was present in 29% of the cranes collected from Texas, but 82% of these were from southern Texas. Thus, the

TABLE 2. Relationship of prevalence, intensity, and abundance of *Orchipedium jolliei* and *Tetrameres grusi* between sandhill crane populations based on the presence or absence of the P1 protein.

P1 protein	Prevalence				Intensity				Abundance			
	O. jolliei		*T. grusi*		*O. jolliei*		*T. grusi*		*O. jolliei*		*T. grusi*	
	No. infected/ no. examined	%	No. infected/ no. examined	%	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE
Absent	35/82	42.7	31/82	37.8	9.7	2.0	11.2	5.3	4.1	1.0	4.8	2.3
Present	26/34	76.5	18/34	52.9	9.1	6.9	6.5	1.7	7.0	1.6	5.0	1.3

majority of the cranes wintering in the Texas Panhandle represent the Alaska population while those from southern Texas are from the Canadian population. Conversely, results of cluster analyses on rank abundances of helminth species indicate greater similarities of the Alaska cranes with those from southern Texas, and those from Canada with the birds from the Texas Panhandle. Using data on *O. jolliei* and *T. grusi* as discriminators, stepwise multiple discriminant analysis correctly classified only 70% of individual crane samples into the proper Texas crane population based on the presence or absence of the P1 pancreatic protein. Thus, our results indicated that classifying cranes into populations based on their helminth fauna was unreliable as a technique for management purposes.

Prevalence, intensity, and abundance data for *O. jolliei* and *T. grusi* from each host genetic group are presented in Table 2. There was a significant difference for *O. jolliei* between genetic groups, with higher abundances in cranes with the P1 protein. *Tetrameres grusi* also was significantly different between genetic groups, with higher abundances in cranes with the P1 protein. Iverson et al. (1983) found higher prevalences of *O. jolliei* in *G. canadensis rowani*, the eastern subspecies, than in *G. canadensis canadensis*, the western subspecies. However, they found no significant differences in *T. grusi* between subspecies. Our study indicated significant differences for both *O. jolliei* and *T. grusi* between sandhill crane populations in Texas.

As noted previously, these differences in helminth species abundances cannot be used to separate sandhill crane populations for management purposes. However, the differences in helminth abundances between the breeding populations wintering in Texas do indicate the importance of geographic origin on the helminth community of this host species.

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