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PARASITES OF WATERFOWL FROM SOUTHWEST TEXAS: III. THE GREEN-WINGED TEAL, *Anas crecca*

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Abstract: Seventy of 72 green-winged teal, *Anas crecca*, from southwest Texas were infected with parasites. Seventeen species of endoparasites were recorded: *Notocotylus attenuatus*, *Zygocotyle lunata*, *Typhlocoelum sisowi*, *Echinostoma revolutum*, *Hypoderaeum conoideum*, *Dendritobilharzia pulverulenta*, *Cloacotaenia megalops*, *Sobolevicanthus gracilis*, *Sobolevicanthus krabbeella*, *Gastrotaenia cygni*, *Amidostomum acutum*, *Amidostomum anseris*, *Tetrameres crami*, *Echinuria uncinata*, *Corynosoma constrictum*, *Polymorphus minutus*. Also recorded were five species of ectoparasites: *Trinoton querquedulae*, *Anaticola crassicornis*, *Anatoecous icterodes*, *Holomenopon setigerum* and *Epidermoptes* sp. and the sarcosporidian, *Sarcocystis rileyi*.

Anatoecous icterodes is a new host record for *A. crecca*. *Sobolevicanthus gracilis*, *S. krabbeella*, *T. sisowi*, and *D. pulverulenta* are new records for *A. crecca* in North America. *Sobolevicanthus krabbeella* is also a new record for North America.

Fall juveniles had greater mean parasite intensity (29) than fall (19) and spring adults (19). Juveniles were infected with fewer species of parasites (17) than adults (20).

Simpson's index was very low (0.11) indicating a diverse parasite fauna. Sorenson's index of similarity indicated that the parasite fauna for green-winged teal from southwest Texas was more similar to the shoveler's, *Anas clypeata*, parasites reported from southwest Texas (55%) than to green-winged teal parasites reported from eastern Canada (41%) and New Brunswick, Canada (21%).

INTRODUCTION

This is the third paper in the series reporting on parasites harbored by waterfowl from the southwestern United States. The first two were concerned with the cinnamon teal, *Anas cyanoptera septentrionalium*, and the shoveler, *Anas clypeata*.^{1,21}

This paper presents information about the parasites recovered from the green-winged teal, *Anas crecca*, and compares our observation on geographic distributions of parasites in fall and spring migrants to those by others.
1-5,6,7,11-16,20,21

The green-winged teal, a common migrant in the Southwest, migrates in the fall from breeding grounds in northern United States and in Canada to

wintering areas in the United States Gulf States and Mexico and returns to its breeding grounds in the spring.¹⁷ Green-winged teal utilize the western edge of the Central Flyway and transitory populations of this duck use the Rio Grande Valley in El Paso County and Hudspeth County, Texas.

METHODS AND MATERIALS

Seventy-two green-winged teal, *A. crecca*, were shot in the Rio Grande Valley, Hudspeth County, Texas: fall migrants in September, 1975 and October, 1976; and spring migrants in June, 1975, and March, 1976 and 1977. Ducks were placed on ice in individual plastic bags after collecting; those not examined within six hours were frozen and exam-

ined later. Age was determined by plumage and presence or absence of the bursa of Fabricius.⁵

Trematodes and cestodes were fixed in alcohol-formalin-acetic acid (AFA), stained in Ehrlich's hematoxylin and mounted in Canada balsam. Acanthocephala were fixed in AFA, stained in Van Cleave's hematoxylin and mounted in Permount. Nematodes were fixed in 70% ethanol and then cleared and studied in temporary lactophenol mounts. Ectoparasites were fixed in 70% ethanol, cleared in 10% KOH and mounted in polyvinyl alcohol or in Lipshaw's mounting media. *Sarcocystis rileyi* was observed by visual examination of the breast and leg muscles. Examination for blood parasites was not done.

Prevalence was defined as percent of ducks infected and the mean intensity as the mean number of parasites per infected bird.

Differences in prevalence of parasitism among fall adults, fall adults plus juveniles, juveniles, and spring adults were analyzed by applying the Chi-square test without an *a priori* hypothesis and utilizing the Yates correction factor. Significance was assumed for $P < .05$. Mean intensity ratios (MIR) were calculated by using the smaller mean intensity from fall or spring as the denominator.

Simpson's index was calculated to measure the concentration for dominance of parasite species and Sorenson's index of similarity was used to compare parasite faunas from southwest Texas to other areas in North America as used by Stone and Pence.¹⁹

Parasites infecting migratory birds are unique in the sense that they may be transported over long distances. It is also apparent that some parasites are capable of infecting proper hosts over extensive geographic areas and others are not. Ultimately the transported range and the infective range of these parasites needs to be elucidated and mapped. As

more ecological studies are done and results are published it may be possible to do this. The following two terms are proposed to reflect the above.

Parasite Geographic Range (PGR) = the total region that a parasite is transported by the migratory bird host.

Parasite Infective Geographic Range (PIGR) = the total region where infection of the migratory bird host is known to take place.

The Parasite Geographic Range is equal to or greater than the Parasite Infective Geographic Range ($PGR \geq PIGR$).

RESULTS AND DISCUSSION

Sixteen species of helminth parasites, five species of ectoparasites, and *Sarcocystis rileyi*, were recorded. Fifteen of the 16 species of helminths were observed in fall migrants and 13 species were recorded for spring migrants. Fall juveniles had a greater mean intensity (29) than both fall (19) and spring (19) adults. Juveniles were infected with fewer species of parasites (17) than adults (20). A summary of results is given in Table 1.

Anatoecous icterodes is a new host record for *A. crecca*. *Sobolevicanthus gracilis*, *Sobolevicanthus krabbeella*, *Typhlocoelum sisowi*, and *Dendrobilharzia pulverulenta* are new host records for *A. crecca* in North America. *Sobolevicanthus krabbeella* is also a new record for North America.

The parasite fauna recorded here for the green-winged teal was determined to be diverse by Simpson's Index (0.11). This diverse fauna, however, was more similar, by Sorenson's Index of Similarity, to the parasite fauna of the shoveler, *Anas clypeata*, (55%) reported from southwest Texas¹ than to the parasite fauna reported from both eastern Canada²⁰ (41%) and New Brunswick, Canada¹⁶ (21%). Earlier, an analogous similarity among two species of ducks from a common geographical area had

TABLE 1. Helminths and ectoparasites of the green-winged teal, *Anas crecca*, from southwest Texas.

	Fall Adults (19)		Fall Juveniles (14)		Spring Adults (37)		Totals (70)		Mean Intensity
	No.	% Infected	No.	% Infected	No.	% Infected	No.	% Infected	
TREMATODA (6)									
<i>Notocotylus attenuatus</i>	4	21	4	29	5	14	13	19	4.3
<i>Zygocotyle lunata</i>	2	11	3	21	8	22	13	19	1.5
<i>Echinostoma revolutum</i>	2	11	2	14	2	5	6	9	2.8
<i>Typhlocoelum sisowi</i>	1	5	2	14	1	3	4	6	10.3
<i>Dendritobilharzia pulverulenta</i>	0	0	1	7	1	3	2	3	1.0
<i>Hypoderaeum conoideum</i>	0	0	0	0	2	5	2	3	2.5
CESTODA (4)									
<i>Cloacotaenia megalops</i>	10	53	4	29	18	49	32	46	2.2
<i>Sobolevicanthus gracilis</i>	6	32	4	29	6	16	16	23	1.6
<i>Gastrotaenia cygni</i>	2	11	1	7	4	11	7	10	4.3
<i>Sobolevicanthus krabbeella</i>	3	16	0	0	1	3	4	6	4.0
ACANTHOCEPHALA (2)									
<i>Corynosoma constrictum</i>	6	32	5	36	0	0	11	16	1.6
<i>Polymorphus minutus</i>	5	26	4	29	0	0	9	13	1.8
NEMATODA (4)									
<i>Amidostomun acutum</i>	9	47	6	43	21	57	36	51	4.7
<i>Tetrameres crami</i>	9	47	6	43	10	27	25	36	1.5
<i>Amidostomun anseris</i>	2	11	0	0	4	11	6	9	1.8
<i>Echinuria uncinata</i>	0	0	1	7	0	0	1	1	1.0
ECTOPARASITES (5)									
<i>Trinoton querquedulae</i>	17	90	13	93	31	84	61	87	1.6
<i>Anaticola crassicornis</i>	11	58	14	100	28	76	53	76	2.5
<i>Anatoecous icterodes</i>	6	32	5	36	16	43	27	39	2.5
<i>Holomenopon setigerum</i>	0	0	1	7	10	27	11	16	2.1
<i>Epidermoptes</i> sp.	0	0	1	7	0	0	1	1	1.0

been reported by Mahoney and Threlfall,¹⁵ who found a very high index of similarity (76%) for trematodes, nematodes and acanthocephalans shared between *Anas rubripes* and *Bucephala clangula* collected in southern Ontario and eastern Canada, species which are less closely related than the green-winged teal and the shoveler. These data do appear to substantiate a difference in parasite fauna between the northern breeding grounds and the southern wintering grounds and a similarity of parasites among some species of waterfowl during the time they occupy the same geographic regions, that is, breeding or wintering grounds.

Mean intensity ratios calculated for the four major groups of parasites indicated higher intensities in fall green-winged teal, Table 2. At least in this species of duck there appears to be a loss of numbers of parasites as the birds migrate and occupy the wintering areas.

Trematoda

There was no significant difference for species of trematode parasites among groups of green-winged teal.

Buscher,² Wilkinson *et al.*²¹ and Broderson *et al.*¹ reported that *Notocotylus attenuatus* occurred more frequently in ducks collected in the fall. Turner and Threlfall²⁰ reported this parasite in 31% of *A. crecca* collected in eastern Canada with juvenile teal exhibiting a range of infection from 1-636. Crichton and Welch⁶ reported *N. attenuatus* for both adult and juvenile mallards, *Anas platyrhynchos*, and pin-

tails, *Anas acuta*, apparently collected in the summer in the Delta Marsh, Manitoba. These data tend to indicate that the PIGR of this parasite is in the more northern range of the ducks and a reduction in this parasite's numbers is occurring during fall migration.

Turner and Threlfall²⁰ found only two specimens of *Zygocotyle lunata* in two of 87 *A. crecca* in eastern Canada; both infected birds were adults. Buscher³ reported a higher prevalence for *Z. lunata* in the blue-winged teal *A. discors* collected in Manitoba in the spring than in the winter and he suggested that additional infections probably occurred during spring migration. Crichton and Welch⁶ also reported this parasite from adult and juvenile mallards and pintails in Manitoba. Gower⁷ reported prevalences for *Zygocotyle* sp. from ducks collected near Augusta, Michigan: spring (17.5%), summer (23%), fall (4%), and winter (10%). It appears that the PIGR of this parasite extends from the nesting grounds in the north on to the wintering grounds.

Echinostoma revolutum is a common parasite of waterfowl. In this study it was found in all groups of green-winged teal. Both its PIGR and PGR appear to extend from the breeding grounds^{3,6,7,15,16,20} onto the wintering grounds.^{1,21}

Typhlocoelum sisowi prevalence was low but occurred in all groups of birds. Caballero⁴ found this trematode in *Anas boschas* collected near Mexico City. We have observed this parasite in *A. discors* collected in Hudspeth County, Texas (A.G.C., unpublished data). Buscher,³

TABLE 2. Mean intensities and mean intensity ratios for parasite groups — green-winged teal, *A. crecca*, from southwest Texas.

Parasite Groups	Fall (33)	Spring (37)	MIR
Trematoda	3.2	0.7	4.6F*
Cestoda	9.9	8.7	1.1F
Acanthocephala	0.6	0.0	—F
Nematoda	4.8	3.4	1.4F

*F = fall intensities predominate

McLaughlin and Burt,¹⁶ and Turner and Threlfall²⁰ did not report this parasite for *A. discors* or *A. crecca* collected in Canada. The PIGR and PGR of this parasite may be restricted to the wintering area.

Two green-winged teal were infected with one specimen each of *Dendrotilharzia pulverulenta*. One of us has found this parasite commonly infecting spring migrating blue-winged teal from Hudspeth County, Texas and blue-winged teal collected near Sisal, Yucutan (A.G.C., unpublished data). It was reported from one shoveler collected in the fall.¹ The PIGR of this parasite appears to be southerly, on the wintering grounds, and *A. crecca* may not be a favorable host.

Hypoderaeum conoideum occurred in two spring migrants and only five parasites were recovered. It was not reported for the shoveler, or cinnamon teal, *A. cyanoptera septentrionalium*, from southwest Texas.^{1,21} It has been reported from Canada in adult and juvenile mallards, and pintails,⁶ and blue-winged teal and juvenile green-winged teal.²⁰ This parasite's PIGR appears to be more northerly, on the breeding grounds.

Cestoda

There were no significant differences for species of cestode parasites among the groups of green-winged teal.

Cloacotaenia megalops was described by Larios¹⁰ from *A. cyanoptera*, *A. discors* and the American coot, *Fulica americana*, all collected in Lago de Texcoco, Mexico. It has been reported from the green-winged teal collected in Wisconsin.²⁰ The prevalence has been high in both fall and spring migrants for cinnamon teal and shoveler collected in southwest Texas.^{1,21} It has been reported from Canada in adult and juvenile mallards, and pintails,⁶ blue-winged teal,^{3,16} American widgeon, *Anas americana*,¹⁶ and from the non-migratory Florida duck, *Anas*

platyrhynchos fulvigula, collected in Florida.⁹ The PIGR of this parasite appears to extend from the breeding to the wintering grounds.

Sobolevicanthus gracilis was recovered from all groups of green-winged teal. This is a new host record for the parasite in North America. Schiller¹⁸ found it in the mallard, black duck, *Anas rubripes*, and lesser scaup, *Aythya affinis*, collected in Michigan, Ohio and Wisconsin. McLaughlin and Burt¹⁶ reported it from the black duck, blue-winged teal, wood duck, *Aix sponsa*, and American widgeon all collected in New Brunswick, Canada. McDonald¹² lists it as a common waterfowl parasite but most citations for it refer to Eurasian waterfowl. The PGR and perhaps the PIGR of this parasite extends from the breeding to the wintering grounds.

Gastrotaenia cygni was recovered from all groups of green-winged teal. It was found in adult and juvenile mallards and pintails collected in Manitoba,⁶ and in the shoveler from Colorado²² and southwest Texas.¹ Its PGR extends from the breeding grounds to the wintering grounds. Its PIGR is apparently on the breeding grounds and it may extend to the wintering grounds.

Sobolevicanthus krabbeella was recovered from fall and spring adult green-winged teal. This is a new host and North American record.

Acanthocephala

Corynosoma constrictum and *Poly-morphus minutus* were recovered only in fall migrating green-winged teal during September, 1975, and October, 1976, with a prevalence of 16% and 13% respectively.

There were significant differences for both species of parasites with prevalence significantly higher for fall adults and juveniles compared independently to spring migrants. There were no significant differences for either species of parasite between fall adults and juveniles.

Corynosoma constrictum has been found in mallards and pintails from Manitoba,⁶ in pintails, shovelers, and gadwall, *Anas strepera*, from Manitoba, Kansas, and Galveston, Texas,² black duck, green-winged teal, and blue-winged teal from New Brunswick,¹⁶ and in cinnamon teal from southwest Texas.¹ It was found in three of five juvenile (non-flying) blue-winged teal collected in Eastern Canada.²⁰ Buscher² reported it in ducks on the wintering grounds in Texas and spring migrants returning to the Delta Marsh, Manitoba. Buscher¹ also reported a high prevalence in adult (59%), and juvenile (69%), blue-winged teal collected in Manitoba. The PGR extends from the breeding to the wintering grounds. The PIGR may extend from the breeding to the wintering grounds.

Polymorphus minutus has been found in the black duck, green-winged teal and blue-winged teal collected in New Brunswick.¹⁶ Its PGR extends from the breeding to the wintering grounds.

Nematoda

There were no significant differences for species of nematode parasites among the waterfowl groups.

The prevalence of *Amidostomum acutum* was 51% and it was present in all groups of green-winged teal. It has been found in adult and juvenile green-winged teal and blue-winged teal, and locally hatched blue-winged teal unable to fly in eastern Canada,²⁰ the non-migratory Florida duck collected in Florida⁹ and the shoveler duck from southwest Texas.¹ The PIGR appears to extend from the breeding to the wintering grounds.

The prevalence of *Tetrameres crami* was 36% and it was found in all groups of green-winged teal. It has been found in adult and juvenile mallards and pintails collected in Manitoba,⁶ the non-migratory Florida duck collected in Florida⁹ and the shoveler from southwest Texas.¹ Its PIGR appears to extend from the breeding to the wintering grounds.

The prevalence of *Amidostomum anseris* was 9% and was recovered from

fall and spring adults. This is more commonly a parasite of geese. Crichton and Welch⁶ found it in adult and juvenile mallards and pintails collected in Manitoba. Prevalence was high (53%) particularly among juveniles (62%). The PGR extends from the breeding to the wintering grounds.

The prevalence of *Echinuria uncinata* was 1% and it was found only in juvenile green-winged teal. This parasite has been found in adult and juvenile mallards and pintails,⁶ blue-winged teal collected in Manitoba³ and in the Florida duck.⁹ The PIGR of this parasite extends from the breeding to the wintering grounds.

Sarcosporidia

Sarcocystis rileyi was found in four spring adult green-winged teal. This was also reported from the shoveler from southwest Texas,¹ but in two fall migrants. Hoppe⁸ recorded a 4.76% prevalence for adult green-winged teal collected in North Dakota.

Ectoparasites

The prevalence for *Trinoton querquedulae* was 87% and there was no significant difference in prevalence among the groups of green-winged teal. This parasite probably infests the host throughout the year.

Anaticola crassicornis infested a significantly higher number of juveniles than either adult groups. There was no significant difference in prevalence between spring and fall adults.

There was no significant difference in prevalence for *Anatoecous icterodes* among the groups of green-winged teal. This is a new host record.

There was a significantly higher prevalence for *Holomenopon setigerum* in spring adults than for fall adults, but not between spring adults and juveniles. This pattern of prevalence was also observed for this parasite in shovelers collected in southwest Texas.¹

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