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Helminths of Wintering Geese in Texas

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ABSTRACT: Ten Canada geese (*Branta canadensis*), 24 snow geese (*Chen caerulescens*) and 22 white-fronted geese (*Anser albifrons*) from coastal Texas (USA) were examined for helminths. Three cestode, seven nematode, and three trematode species were collected. Gizzard nematodes (*Amidostomum anseris, A. spatulatum* and *Epomidiostomum crami*) infected 53 of 54 birds. Gross lesions were not attributed to helminth infections and the host population does not appear to be impaired by them.

Key words: *Anser albifrons, Branta canadensis,* Canada goose, *Chen caerulescens,* geese, gizzard nematodes, helminths, snow goose, white-fronted goose.

Gizzard nematodes of the genera *Amidostomum* and *Epomidiostomum* are known to cause significant lesions in wild geese (Tuggle and Crites, 1984). While not a significant cause of mortality by themselves, gizzard nematodes may have an additive effect on mortality in combination with other factors such as malnutrition and crowding (Herman and Wehr, 1954). The objective of this paper was to determine the prevalence and intensity of helminths from Canada geese (*Branta canadensis*), snow geese (*Chen caerulescens*) and white-fronted geese (*Anser albifrons*) wintering on the gulf coastal prairies of Texas, with particular reference to gizzard nematodes.

Geese were collected in December 1991 to February 1992 (n = 38) and December 1992 to February 1993 (n = 18) in Colorado (29°45′N, 96°30′W) and Wharton (29°15′N, 96°15′W) counties, Texas (USA). Feeding geese were shot with a rifle and stored on ice until viscera were removed at the end of the day. All geese collected in 1991–92 and five of those collected in 1992–93 had the esophagus, proventriculus and gizzard removed and frozen; the final 13 birds had all internal organs frozen. Rifle bullets rendered two gizzards unusable. Weights were taken to the nearest 5 gm with a spring scale at the time of collection.

Viscera were examined after thawing at room temperature. Intact viscera were removed and examined for gross lesions with a dissecting microscope. The intestinal tract was cut length-wise and all contents scraped into a petri dish, mixed with saline, then subsequently examined for helminths. Nematodes were fixed in 70% ethanol with 5% glycerine and permanently mounted in glycerine jelly. Cestodes and trematodes were stained in Semichon's acetocarmine, sequentially dehydrated in ethanol, cleared in xylene, and mounted in Kleermount (Carolina Biological Supply Company, Burlington, North Carolina USA).

Cestodes were identified according to Schmidt (1986). Nematodes were identified according to Yamaguti (1961) and McDonald (1974). We identified trematodes according to Yamaguti (1971a, b) and McDonald (1981). Cestodes and trematodes were counted directly. The species, sex and portion (whole, anterior, posterior, center) of nematodes were recorded and a minimum possible number present calculated. Representative nematode specimens were deposited in the U.S. National Parasite Collection (Beltsville, Maryland USA; accession numbers 84,197 to 84,206, 84,209, 84,211 and 84,214 to 84,215) and the Harold Manter Laboratory (University of Nebraska State Museum, Lincoln, Nebraska USA; accession numbers 37,973 to 37,986, 37,990 and 37,992).

Independence of gizzard nematode

TABLE 1. Mean intensity, range, and prevalence of helminths from geese collected in Colorado and Wharton counties, Texas during winters 1991–92 and 1992–93.

Species	Canada geese	Snow geese	White-fronted geese	Total Geese
	MI[a] (range) P[b]	MI (range) P	MI (range) P	MI (range) P
Cestoda				
Drepanidotaenia sp.	– (–) 0/1	1.0 ± 0 (1) 2/7	– (–) 0/5	1.0 ± 0 (1) 2/13
Microsomacanthus sp.	– (–) 0/1	5.0 (5) 1/7	– (–) 0/5	5.0 (5) 1/13
Retinometra sp.	– (–) 0/1	1.0 ± 0 (1) 3/7	– (–) 0/5	1.0 ± 0 (1) 3/13
Unknown sp.	– (–) 0/1	4.0 (4) 1/7	– (–) 0/5	4.0 (4) 1/13
Nematoda				
Amidostomum spp.[c]	1.5 ± 0.7 (1–2) 2/10	1.0 ± 0 (1) 2/22	1.5 ± 0.7 (1–2) 2/22	1.3 ± 0.5 (1–2) 6/54
Amidostomum anseris	3.6 ± 2.7 (1–7) 7/10	3.1 ± 2.6 (1–8) 10/22	1.8 ± 1.3 (1–4) 5/22	3.0 ± 2.4 (1–8) 22/54
Amidostomum spatulatum	2.5 ± 1.9 (1–5) 4/10	3.2 ± 6.0 (1–18) 8/22	6.3 ± 4.5[d] (1–16) 15/22	4.9 ± 4.0 (1–18) 27/54
Epomidiostomum crami	5.7 ± 5.5[d] (1–14) 6/10	15.9 ± 9.9 (1–35) 21/22	19.9 ± 15.2 (1–58) 22/22	16.4 ± 12.8 (1–58) 49/54
Total gizzard nematodes	8.0 ± 8.1[d] (1–24) 9/10	17.8 ± 10.3 (2–36) 22/22	24.7 ± 16.4 (3–61) 22/22	19.0 ± 14.1 (1–61) 53/54
Capillaria obsignata	– (–) 0/1	8.0 ± 9.9 (1–15) 2/7	– (–) 0/5	8.0 ± 9.9 (1–15) 2/13
Heterakis dispar	– (–) 0/1	29.5 ± 36.6 (1–80) 4/7	4.0 (4) 1/5	24.4 ± 33.7 (1–80) 5/13
Tetrameres sp.	– (–) 0/10	– (–) 0/24	1.5 ± 0.6 (1–2) 4/22	1.5 ± 0.6 (1–2) 4/56
Trichostrongylus tenuis	– (–) 0/1	24.7 ± 35.0 (3–65) 3/7	14.0 (14) 1/5	22.0 ± 29.0 (3–65) 4/13
Unknown sp.	– (–) 0/1	2.0 ± 0 (2) 2/7	1.0 (1) 1/5	1.7 ± 0.6 (1–2) 3/13
Trematoda				
Echinoparyphium recurvatum	– (–) 0/1	2.0 (2) 1/7	– (–) 0/5	2.0 (2) 1/13
Echinostoma revolutum	2.0 (2) 1/1	7.5 ± 9.2 (1–14) 2/7	1.0 (1) 1/5	4.5 ± 6.4 (1–14) 4/13
Zygocotyle lunata	– (–) 0/1	1.0 (1) 1/7	1.0 ± 0 (1) 2/5	1.0 ± 0 (1) 3/13
Unknown sp.	– (–) 0/1	1.0 (1) 1/7	– (–) 0/5	1.0 (1) 1/13

[a] Mean intensity ± standard deviation.
[b] Number examined/number infected.
[c] Either *A. anseris* or *A. spatulatum*.
[d] Mean intensity is significantly different from that in other host species for this parasite.

prevalence to host species and prevalences of individual species to each other were tested with Fisher's exact test (SAS Institute Inc., 1988a). Differences in gizzard nematode mean intensity due to host species were tested with the Kruskal-Wallis test (SAS Institute Inc., 1988a); if a significant difference was found, a multiple comparison test (Daniel, 1990) was used to separate species. All intensities are reported as means ± standard deviation. Correlation of host weight with total gizzard nematode intensity and intensities of individual gizzard nematode species to each other was tested with the Spearman rank-order correlation (SAS Institute Inc., 1988b). A significance level of $P \leq 0.05$ was used for all tests except the multiple comparison, which used $P \leq 0.15$ (Daniel, 1990).

Amidostomum anseris, *A. spatulatum* and *Epomidiostomum crami* were found under the koilin lining in 53 of 54 (98%) gizzards. A monotypic infection was in 15 of 54 (28%), *E. crami* was found with either *A. anseris* or *A. spatulatum* in 31 of 54 (57%), and all three species were found together in seven of 54 (13%) hosts. None of the individual geese had both *A. anseris* and *A. spatulatum* without also being infected with *E. crami*. *Amidostomum anseris* and *E. crami* prevalences were significantly dependent on host species. Prevalence of *E. crami* was independent of *A. anseris* and *A. spatulatum*. *Amidostomum anseris* was marginally independent ($P = 0.051$) of *A. spatulatum*, but in a negative relationship. Mean intensity of gizzard nematodes was 19.0 ± 14.1; *E. crami* (16.4 ± 12.8) comprised 80% of all gizzard nematodes. Significant differences in intensity due to host species were found for *A. spatulatum*, *E. crami* and total gizzard nematodes (Table 1). Significant correlations of host weight and intensity of total gizzard nematodes or intensity of gizzard nematode species to each other were not found.

Tetrameres sp. was found in four of 56 (7%) proventriculi examined. Likewise, the three cestodes found in the small intestine (*Drepanidotaenia* sp., *Microsomacanthus* sp. and *Retinometra* sp.) were not identified to species because of freezing damage and a lack of scolices. *Heterakis dispar* (ceca and small intestine) (24.4 ± 33.7) and *Trichostrongylus tenuis* (ceca) (22.0 ± 29.0) were found in five and four birds, respectively. *Capillaria obsignata* was found in the small intestine of two snow geese. Three species of trematodes (*Echinoparyphium recurvatum* in the small intestine, *Echinostoma revolutum* in the large and small intestine, and *Zygocotyle lunata* in the ceca) were collected.

McDonald (1974) listed *A. anseris* as characteristic, *A. spatulatum* as frequent, and *E. crami* as common in waterfowl. *Amidostomum anseris* has caused mortality events in domestic geese (Cram, 1926) and it is considered as a significant pathogen in domestic geese in Europe (Herman and Wehr, 1954). A population of Canada geese in North Carolina (USA) had a 98% prevalence of *A. anseris*; 100% of sick individuals and 90% of healthy birds were infected (Herman and Wehr, 1954). Infection with *A. anseris*, along with nutritional factors, was thought to be a primary cause of weight loss and mortality in this population (Herman et al., 1955). Tuggle and Crites (1984) found 100 and 60% ($n = 25$) of snow geese in Ontario (Canada) were infected with two and three species of gizzard nematodes, respectively. Erosion of the mucosal lining and degeneration of the koilin in the gizzard were noted in dual *A. anseris* and *A. spatulatum* infections with >30 nematodes. *Epomidiostomum crami* caused lesions in the gizzard musculature, and these lesions in conjunction with small necrotic granulomata caused by the nematode were thought to affect gizzard function (Tuggle and Crites, 1984). Tuggle (1982) noted that although all three species of gizzard nematode caused damage to Canada geese, *E. crami* was the most pathogenic. Although nematode intensities in our study were lower than those found by Tuggle and Crites (1984), gross mucosal erosion and pigment deposition was pres-

ent in virtually every bird. The remaining helminths collected in this study were found at low mean intensity and did not appear to cause gross tissue damage.

Although numerous helminths were collected from geese, there were no signs of significant tissue damage and no correlation of host weight with parasite intensity. Only gizzard nematodes caused gross lesions, and these appeared to be minor. Therefore, we feel that this goose population was not seriously impaired by the helminths.

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