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Gizzard Helminths in Female Northern Pintails (*Anas acuta*) Wintering Along the Texas Coast

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ABSTRACT: Gizzard helminths were examined in 100 (50 adult, 50 juvenile) female northern pintails (*Anas acuta*). Sixty-three individual helminths, representing 5 species (*Amidostomum acutum*, *Echinuria uncinata*, *Epomidiostomum uncinatum*, *Streptocara crassicauda*, and *Gastrotaenia cygni*) were found. Twenty-seven northern pintails were infected with 1–3 helminth species and averaged 1.4 species. Overall, *A. acutum* and *G. cygni* were the most prevalent and abundant species (20%, n = 31 and 10%, n = 25, respectively), followed by *S. crassicauda* (5%, n = 5), *E. uncinata* (1%, n = 1), and *E. uncinatum* (1%, n = 1). Intensity of infection for *A. acutum*, *E. uncinata*, *E. uncinatum*, *S. crassicauda*, and *G. cygni* was 1.6 ± 0.3 [SE], 1.0 ± 0, 1.0 ± 0, 1.0 ± 0, and 2.5 ± 0.6, respectively. Our findings represent new information about gizzard helminth infections in northern pintails wintering along the Texas coast.

Helminth studies have been conducted in southern Texas on migratory blue-winged teal (*Spatula discors*) (Garvon et al., 2011; Graves and Fedynich, 2013), black-bellied whistling-ducks (*Dendrocygna autumnalis*) and fulvous whistling-ducks (*Dendrocygna bicolor*) (Fedynich et al., 1996a), and nonmigratory mottled ducks (*Anas fulvigula*) (Fedynich et al., 1996b). However, helminth infections occurring in other waterfowl species in coastal areas of southern Texas are not well understood. Because 4 species of nematodes (*Amidostomum acutum*, *Echinuria uncinata*, *Epomidiostomum uncinatum*, and *Streptocara crassicauda*) and a cestode species (*Gastrotaenia cygni*) found in duck gizzards can cause disease (Cornwell, 1963; Crichton and Welch, 1972; Turner and Threlfall, 1975), we initiated this study to learn more about the infections of gizzard worms in the northern pintail (*Anas acuta*)—a migratory waterfowl species that winters along the coast of Texas.

Fifty juvenile and 50 adult female northern pintails were collected along the coast of Texas between 15 October 2014 and 15 March 2015, aged by wing and other feather characteristics, and frozen until necropsy as part of a larger study on northern pintail ecology (Garrick, 2016). Upon carcass necropsy, gizzards were cut open and flushed to remove food and grit contents. The koilin was scraped off and washed into a pan and the corresponding sediment wash examined under a dissection microscope for helminths. Nematodes were removed and fixed in glacial acetic acid for 1–5 min and stored in 70% ethanol and 8% glycerin. Cestodes were placed in alcohol–formalin–acetic acid (AFA) for 20–30 min and stored in 70% ethanol. Helminths were identified (Wolffhügel, 1938; McDonald, 1974) and counted in alcohol–glycerin wet-mount slides with the use of a light microscope. Representative specimens were deposited at the Sam Houston State University Parasite Museum, Sam Houston State University, Huntsville, Texas. Parasite ecological terminology follows Bush et al. (1997).

Sixty-three individual helminths, representing 5 species (*A. acutum* SHSUP001600, *E. uncinatum* SHSUP001601, *S. crassicauda* SHSUP001602, *E. uncinata* SHSUP001603, and *G. cygni* SHSUP001604) were found at the component community level (Table I). Each species occurred infrequently (≤20% prevalence across the host sample), precluding statistical comparisons. *Amidostomum acutum* and *G. cygni* were the most prevalent and abundant species, followed by *S. crassicauda*, *E. uncinata*, and *E. uncinatum* (Table I). It is likely that *E. uncinata* was underrepresented in our study because it can also occur in the proventriculus. Three species (*A. acutum*, *S. crassicauda*, and *G. cygni*) were found in adult northern pintails, whereas 5 species (*A. acutum*, *S. crassicauda*, *E. uncinata*, *E. uncinatum*, and *G. cygni*) were found in juveniles.

Twenty-seven (27%) northern pintails were infected with 1–3 species and averaged 1.4 species. Infections of the 2 most prevalent species, *A. acutum* and *G. cygni*, averaged 1.6 ± 0.3 (SE) and 2.5 ± 0.6 individuals and ranged from 1–6 and 1–7 individuals, respectively. Nineteen (70%) northern pintails were infected with 1 species, 6 with 2 species (22%), and 2 with 3 species (8%). Most of the infections for the 3 most prevalent species (*A. acutum*, *S. crassicauda*, and *G. cygni*) occurred as singletons (Fig. 1).

Examination by host age revealed 16 infected juveniles, of which 13 were infected with *A. acutum*, 5 with *S. crassicauda*, 1 with *E. uncinata*, 1 with *E. uncinatum*, and 5 with *G. cygni*. Of these infected juveniles, mixed infections were found in which 1 juvenile was infected with *A. acutum*, *E. uncinata*, and *E. uncinatum*; 1 was infected with *A. acutum*, *S. crassicauda*, and *G. cygni*; 3 were infected with *A. acutum* and *G. cygni*, 1 infected with *A. acutum* and *S. crassicauda*, and 1 infected with *S. crassicauda* and *G. cygni*. Eleven adults were infected, of which 7 were infected with *A. acutum*, 1 with with *S. crassicauda*, and 5 with *G. cygni*. Multiple infections occurred in 2 adults, in which both individuals were infected with *A. acutum* and *G. cygni*.

Helminth community structure and patterns are shaped by a diverse array of factors including helminth life-history strategies (e.g., specialized feeding guilds, life-cycle complexity, host specialization) and host features (e.g., diet, vagility, geographic distribution, abundance)—all of which are played against the backdrop of a changing seasonal and temporal environment. Findings from the present study indicated that the component community of gizzard helminths consisted of 5 species. Four were nematodes, representing the imbiber feeding guild, and 1 was a cestode, representing the absorber guild. Both *A. acutum* and *E.*

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TABLE I. Descriptive statistics (prevalence, intensity, abundance, range, and total) of helminths found in 100 female northern pintails (*Anas acuta*) collected along the Texas coast between 15 October 2014 and 15 March 2015.

Helminth species	Prevalence (95% confidence interval)	Intensity ($\bar{x}$ ± SE)	Abundance ($\bar{x}$ ± SE)	Range	Total
Amidostomum acutum	20 (12.7–29.2)	1.6 ± 0.3	0.3 ± 0.8	1–6	31
Echinuria uncinata	1 (<0.1–5.5)	1.0 ± 0	<0.1 ± <0.1	1	1
Epomidiostomum uncinatum	1 (<0.1–5.5)	1.0 ± 0	<0.1 ± <0.1	1	1
Streptocara crassicauda	5 (1.6–11.3)	1.0 ± 0	<0.1 ± <0.1	1	5
Gastrotaenia cygni	10 (4.9–17.6)	2.5 ± 0.6	0.3 ± 0.8	1–7	25

uncinatum are monoxenic, whereas *E. uncinata*, *S. crassicauda*, and *G. cygni* are heteroxenic, requiring an intermediate host (McDonald, 1969). However, these 5 species rarely occurred (1–20% prevalence), precluding speculation as to which life-cycle strategy is more successful. In addition, these 5 helminth species are host generalists, in which at least 2–4 have been reported in congeners on the breeding grounds of North America (Buscher, 1966; Crichton and Welch, 1972; Turner and Threlfall, 1975), along migratory corridors (Broderson et al., 1977; Wilkinson et al., 1977; Canaris et al., 1981; Wallace and Pence, 1986; Garvon et al., 2011), and wintering areas in Texas (Gray et al., 1989; Fedynich and Pence, 1994).

Our findings illustrate that cosmopolitan host-generalist helminth species are able to persist across a migratory host's geographic range that encompasses much of North America (Clark et al., 2014). This finding supports the hypothesis that host–helminth systems involving migratory *Anas* spp. are extensions from breeding to wintering areas connected by migratory corridors (McLaughlin and Burt, 1979; Fedynich and Pence, 1994).

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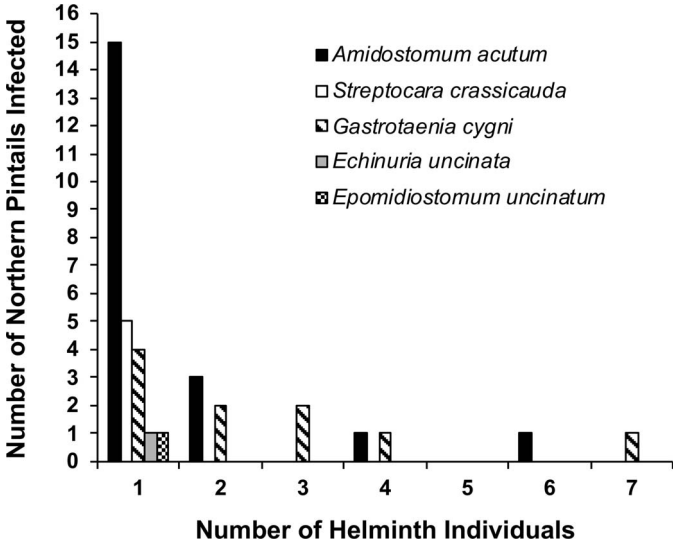

FIGURE 1. Infracommunity distribution of helminth species encountered in 100 female northern pintails (*Anas acuta*) collected along the Texas coast between 15 October 2014 and 15 March 2015.

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