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Parasites (Trematoda, Nematoda, Phthiraptera) of Two Arkansas Raptors (Accipitriformes: Accipitridae; Strigiformes: Strigidae)

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Cover Page Footnote

The Arkansas Game and Fish Commission and U.S. Fish & Wildlife Service issued Scientific Collecting Permits to CTM. We thank Ethan T. Woodyard (Mississippi St. University) for examining some trematodes. We dedicate this paper to the memory of Drs. Douglas A. James (1925–2018) and Kimberly G. Smith (1948–2018), renowned ornithologists of the University of Arkansas.

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Parasites (Trematoda, Nematoda, Phthiraptera) of Two Arkansas Raptors (Accipitriformes: Accipitridae; Strigiformes: Strigidae)

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Running Title: Parasites of Arkansas Raptors

Abstract

Very little is known about the helminth parasites of hawks and owls of Arkansas. We had the opportunity to salvage 2 road-killed raptors, a red-shouldered hawk (*Buteo lineatus*) and a great horned owl (*Bubo virginianus*) from the state and examine them for ecto- and endoparasites. Found were chewing lice (*Degeeriella fulva*) and a nematode (*Porrocaecum angusticolle*) on/in *B. lineatus*, and 3 digenean trematodes (*Echinoparyphium* sp., *Strigea elegans*, *Neodiplostomum americanum*), and nematode eggs (*Capillaria* sp.) in *B. virginianus*. We document 6 new distributional records for these parasites.

Introduction

Birds of prey or raptors make up an invaluable portion of the avian fauna of Arkansas (James and Neal 1986). In adjacent Oklahoma, novel information on the parasites of raptors has been gained recently by our research group from examination of salvaged road-killed specimens (McAllister *et al.* 2017, 2018). However, we are aware of only a single previous report (Richardson and Nickol 1995) on parasites (acanthocephalans) from great horned owls (*Bubo virginianus*) in Benton and Madison counties of the state, and nothing is available on parasites from any hawks of Arkansas. Here, we report new state records for 6 parasites found on/in 2 salvaged raptors of Arkansas.

Materials and Methods

An adult red-shouldered hawk (*Buteo lineatus*) was found dead on the road (DOR) on 9 February 2018 at 3.2 km E of Lockesburg off US 371, Sevier County

(33°57'30.04"N, 94°07'53.78"W). In addition, an adult *B. virginianus* was found DOR on 28 May 2018 off St. Hwy. 14 in the vicinity of Caney, Marion County (36°06'26.18"N, 92°37'53.90"W). These specimens appeared to be recently killed and their bodies showed no sign of putrefaction. They were examined for most parasites but not examined for subcutaneous helminths or *Trichinella* sp. Their feathers were brushed for ectoparasites and those found were placed in a vial of 70% (v/v) ethanol; specimens were cleared in 10% potassium hydroxide, dehydrated through an ethanol series, further cleared in xylene, and slide-mounted in Canada balsam (Price *et al.* 2003). A mid-ventral incision was made to expose the viscera and blood samples were taken directly from the heart, smeared onto a microscopic slide and allowed to dry, then fixed in absolute methanol for 1 minute, stained in Giemsa for 30 minutes, and rinsed in neutral buffered phosphate saline. The gastrointestinal (GI) tract from the throat to cloaca was removed, rinsed in 0.9% saline, and organs placed in individual Petri dishes. Several 100 mm sections of the GI tract were cut, split lengthwise, and examined under a stereomicroscope for endoparasites. Feces from the rectum from both raptors were collected and placed in 2.5% potassium dichromate. Fecal flotations were accomplished with Sheather's sugar solution (sp. gr. 1.30). Trematodes were rinsed in saline, fixed in hot tap water without coverslip pressure, preserved in 70% ethanol, stained in acetocarmine, cleared in methyl salicylate, and coverslip mounted in Canada balsam. Nematode ova from the fecal flotation were placed on a microscopic slide, coverslip mounted, and photographed.

Photovoucher hosts were deposited in the Henderson State University (HSU) collection, Arkadelphia, Arkansas. Voucher specimens of ectoparasites were deposited in the General Ectoparasite

Collection in the Department of Biology at Georgia Southern University, Statesboro, Georgia. The trematodes and nematodes were deposited in the Harold W. Manter Laboratory (HWML) of Parasitology, University of Nebraska, Lincoln, Nebraska, or retained for molecular analyses.

Results and Discussion

A nematode and chewing louse was recovered from *B. lineatus* and 3 digeneans, and a nematode egg was found in *B. virginianus*. An eimerian coccidian was also found in *B. virginianus* and was reported in a recent report that included molecular analyses (McAllister *et al.* 2019). The blood smears were negative and no cestodes or acanthocephalans were found. Data is presented below in annotated format.

TREMATODA: DIGENEA: ECHINOSTOMATIDAE

Echinoparyphium sp. – Very young juvenile specimens of an *Echinoparyphium* sp. was collected from the intestinal tract of *B. virginianus*. *Echinoparyphium* species are common, widely distributed intestinal parasites causing disease in animals worldwide. Intermediate hosts include a variety of taxa, including freshwater snails, mussels, planarians, fish, frogs, and aquatic turtles, whereas the definitive hosts are mainly birds and mammals (Huffman and Fried 2012). *Echinoparyphium recurvatum* (von Linstow) has been reported in *B. virginianus* from Alberta, Canada (Ramalingam and Samuel 1978). We report the genus from Arkansas for the first time.

STRIGEIDAE

Strigea elegans Chandler & Rausch, 1947. – A single specimen was taken from the intestinal tract of *B. virginianus*. This digenean was originally described from 6 of 22 (27%) *B. virginianus* from Wisconsin (Chandler and Rausch 1947). It was later redescribed by Dubois and Rausch (1950) from the same host and locale. The life cycle is a 4-host obligatory one that involves snails as first intermediate hosts, bufonid and ranid tadpoles as second intermediate hosts, watersnakes and ducks as third intermediate hosts (with tetracotyles), and owls as final hosts (Pearson 1959; Miller *et al.* 1965). Kinsella *et al.* (2001) reported *S. elegans* in *B. virginianus* from Florida. We document *S. elegans* from Arkansas for the first time.

DIPLOSTOMIDAE

Neodiplostomum americanum Chandler and Rausch, 1947. – Three specimens were recovered from

the intestinal tract of *B. virginianus*. This trematode has been reported previously from *B. virginianus* from Connecticut, Florida, Mississippi, and Wisconsin (see Woodyard *et al.* 2017). It has also been reported from other raptors, including *Accipiter* spp., *Asio otus*, *Athene cunicularia*, *Buteo* spp., *Megascops asio*, and *Strix varia* from Connecticut, Florida, Louisiana, Mississippi, and Wisconsin, and Ontario, Canada (Woodyard *et al.* 2017). We report a new state record for *N. americanum* as well as the first report of this parasite from west of the Mississippi River.

NEMATODA: ANISAKIDAE

Porrocaecum angusticolle (Molin, 1860) Baylis and Daubney, 1922. – Five (4 male, 1 female) *P. angusticolle* (HWML 110402) were found in the stomach of *B. lineatus*. *Porrocaecum angusticolle* was originally described as *Ascaris angusticollis* by Molin (1860) from specimens collected from the intestines of common buzzard (*Buteo buteo*) and osprey (*Pandion haliaetus*) from Europe. It was transferred to the genus *Porrocaecum* by Baylis and Daubney (1922). This nematode has been reported from 6 species of hawks from the Nearctic Realm (Table 1). We document the first report of *P. angusticolle* from Arkansas.

TRICHURIDA: CAPILLARIIDAE

Capillaria sp. – Ova of a *Capillaria* sp. (Fig. 1) were recovered from the feces of *B. virginianus*. Two capillariid species have previously been reported from *B. virginianus*, including *C. falconis* (Rudolphi) from Florida, Wisconsin, and Alberta, Canada, and *C. tennissima* (Rudolphi) from Florida (Read 1949; Ramalingam and Samuel 1978; Kinsella *et al.* 2001) and Connecticut (Richardson and Kinsella 2010). This is the first time *Capillaria* sp. ova have been reported from any owl from the state.

ARTHROPODA: INSECTA: PHTHIRAPTERA: ISCHNOCERA: PHILOPTERIDAE

Degeeriella fulva (Giebel, 1874). – Several *D. fulva* (Fig. 2) were taken from *B. lineatus*. This louse has been previously reported from *B. lineatus* as well as 27 other species of raptors belonging to 9 different genera (Price *et al.* 2003). We document a new state record for this louse in Arkansas.

In conclusion, we document several new distributional records for parasites of *B. lineatus* and *B. virginianus*. Most importantly, additional parasites are reported for the first time from an Arkansas *B. virginianus* and others from *B. lineatus* from the state.

Parasites of Arkansas Raptors



Figures 1 and 2. Parasites of *Bubo virginianus* and *Buteo lineatus*. (1) Embryonated capillarid egg from feces of *B. virginianus*. Note characteristic bipolar plugs. Scale bar = 250 μ m. (2) Chewing louse, *Degeeriella fulva* from *B. lineatus*. Scale bar = 1.0 mm.

Although this survey included only 2 specimens, it continues to illustrate the significance of salvaging road-killed raptors which can yield knowledge on their parasites that could not be obtained otherwise because of state and federal restrictions on collecting and euthanizing migratory birds.

Acknowledgments

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Table 1. Records of *Porrocaecum angusticolle* in hawks from the Nearctic Realm.

Common Name	Species	Locality	Reference
Cooper's hawk*	<i>Accipiter cooperi</i>	North America*	Morgan and Schiller (1950)
Sharp-shinned hawk*	<i>A. velox</i>	North America*	Morgan and Schiller (1950)
Red-tailed hawk	<i>Buteo borealis</i>	North America†	Canavan (1931)
Red-shouldered hawk	<i>B. lineatus</i>	E. North America*	Morgan and Schiller (1950)
		E. North America†	Canavan (1929)
		Arkansas, USA	This report
Broad-winged hawk	<i>B. platypterus</i>	North America*	Morgan and Schiller (1950)
		Florida, USA	Kinsella <i>et al.</i> (1995)
Marsh hawk	<i>Circus hudsonius</i>	North America*	Morgan and Schiller (1950)

*Locales not given.

†Captives from Philadelphia Zoo.