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# New Ectoparasite (Diptera; Phthiraptera) and Helminth (Trematoda; Cestoda; Nematoda) Geographic Records from Three Species of Owls (Strigiformes) in Southeastern Oklahoma

**Chris T. McAllister**

Science and Mathematics Division, Eastern Oklahoma State College, Idabel, OK 74745

**John M. Kinsella**

HelmWest Laboratory, 2108 Hilda Avenue, Missoula, MT 59801

**Lance A. Durden**

Department of Biology, Georgia Southern University, Statesboro, GA 30458

**Will K. Reeves**

Colorado State University, C. P. Gillette Museum of Arthropod Diversity, Fort Collins, CO 80521

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**Abstract:** We are just now beginning to learn about the ectoparasites and helminth parasites of some owls of Oklahoma. Some recent contributions from our lab have attempted to help fill a previous void in that information. Here, we report, four taxa of ectoparasites and five helminth parasites from three species of owls in Oklahoma. They include two species of chewing lice (*Strigiphilus syrnii* and *Kurodeia magna*), two species of hippoboscid flies (*Icosta americana* and *Ornithoica vicina*), a trematode (*Strigea elegans*) and a cestode (*Paruterina candelabraria*) from barred owls (*Strix varia*), and three nematodes, *Porrocaecum depressum* from an eastern screech owl (*Megascops asio*), *Capillaria* sp. eggs from *S. varia*, and *Capillaria tenuissima* from a great horned owl (*Bubo virginianus*). With the exception of *Capillaria* sp. eggs and *I. americana*, all represent new state records for Oklahoma and extend our knowledge of the parasitic biota of owls of the state.

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## Introduction

Over 455 species of birds have been reported from Oklahoma and several are species of raptors or birds of prey that make up an important portion of the avian fauna of the state (Sutton 1967; Baumgartner and Baumgartner 1992). However, until recently, little was known about their parasites. Over the last few years, novel information on the parasites of raptors has been gained by our research group from examination of salvaged road-killed specimens (McAllister et al. 2017, 2018, 2019a, b). Here, we continue

to opportunistically examine raptors from the state and document new geographic records for their parasites in Oklahoma.

## Methods

Between January 2018 and September 2019, three owls were found dead on the road in McCurtain County, including an eastern screech owl (*Megascops asio*) collected on 22 January 2018 from Smithville ( $34^{\circ} 28' 0.4794''N$ ,  $94^{\circ} 38' 37.6794''W$ ), a barred owl (*Strix varia*) collected on 1 February 2019 from Hochatown at the jct. of US 259/259A ( $34^{\circ} 06' 52.506''N$ ,  $94^{\circ} 44' 23.28''W$ ), and another *S. varia* collected

on 21 September 2019 from Holly Creek ( $33^{\circ} 58' 40.494''$  N,  $94^{\circ} 49' 03.8892''$  W). These specimens appeared to be recently killed and showed no sign of putrefaction. In addition, an injured great horned owl (*Bubo virginianus*) was a captive specimen in rehab at the Hochatown Rescue Center ( $34^{\circ} 08' 22.074''$  N,  $94^{\circ} 44' 47.328''$  W) and, after four days in captivity, died on 26 August 2019 and was subsequently donated to CTM. All were placed in individual plastic bags on ice and immediately brought to the laboratory at Eastern Oklahoma State College (EOSC) for parasitic examination. Their feathers were vigorously brushed over a white enamel tray to observe ectoparasites and those found were placed in individual vials of 70% (v/v) ethanol; selected 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). Hippoboscidae were passed through 100% acetone for 24 hr, air dried, and point mounted. The specimens were identified using the keys by Maa (1966, 1969a). A midventral incision was made of each owl from the cloaca to throat to expose the viscera and the gastrointestinal tract and associated organs were placed in individual Petri dishes containing 0.9% saline. Contents were examined at 20 to 30 $\times$  under a stereomicroscope and parasites found were rinsed of mucus. Feces from the rectum from each owl was collected and placed in individual vials containing 2.5% (w/v) potassium dichromate ( $K_2Cr_2O_7$ ) and, after flotation in Sheather's sugar solution (sp. gr. 1.30), examined for coccidians and parasite ova by brightfield microscopy. Trematodes were fixed without coverslip pressure in near boiling water and transferred to 95% (v/v) molecular grade ethanol. Cestodes were detached from the host's intestine, gently rinsed in 0.9% saline, and fixed in hot 4% formaldehyde solution (formalin) with subsequent transfer to 95% molecular grade ethanol. Both were stained with acetocarmine, dehydrated in a graded ethanol series, cleared in methyl salicylate, and mounted in Canada balsam. Nematodes were fixed in near boiling water and preserved in 70% (v/v) ethanol. They were later cleared and identified in temporary mounts of lacto-phenol and then

returned to the preservative.

Hosts were deposited as photovouchers and/or housed in the EOSC collection, Idabel, Oklahoma. Voucher specimens of parasites (except those retained for further work) were deposited as follows: (1) helminths in the Harold W. Manter Laboratory of Parasitology (HWML), University of Nebraska, Lincoln, Nebraska; (2) specimens of Phthiraptera in the General Ectoparasite Collection in the Department of Biology at Georgia Southern University, Statesboro, Georgia, under individual accession numbers; and (3) Hippoboscidae in the C. P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins, Colorado. Common and scientific names of owls follow König and Wieck (2008).

## Results and Discussion

A single owl each was infested with two species of lice and two dipterans, and all four owls were infected with various helminths. Nine taxa, including two species of chewing lice, one trematode, one cestode, and two nematodes were collected as well as nematode eggs and two dipterans; no coccidians or acanthocephalans were found. All parasites, except for *Capillaria* sp. ova and *I. americana*, are reported from Oklahoma for the first time. The parasite species recovered are presented below in annotated format.

### Trematoda: Strigeidae

***Strigea elegans* Chandler and Rausch, 1947.** – Several specimens were taken from the intestinal tract of *S. varia* from the Hochatown site. The life cycle is a four-host obligatory one that involves snails as first intermediate hosts, anurans (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) previously reported *S. elegans* from *S. varia* and *B. virginianus* from Florida, and McAllister et al. (2019a) reported it from *B. virginianus* from Arkansas. Specimens are being retained for further work.

### Cestoda: Cyclophyllidea: Parauterinidae

#### *Paruterina candelabrarria* (Goeze, 1872)

**Fuhrman, 1906.** — Several *P. candelabrarria* (HWML 216091) were found in the intestine of *S. varia* from the same site above. One of the major characteristics defining the family is the presence of a single paruterine organ and our specimens clearly possessed this structure (Figs. 1A–B). In North America, larval stages of *P. candelabrarria* have been reported from shrews, deer mice, voles and squirrels (Freeman 1957; Baron 1971; Kinsella 2007), and possibly bats (de Souza 2019), which are regularly eaten by birds of prey (Johnsgard 1990). This tapeworm genus is restricted to a group of three species parasitic in owls; *P. candelabrarria* has a Holarctic distribution (Europe, North Asia and North America). It has also been previously reported from little owls (*Athene noctua*) from China (Guo et al. 2019), Sunda scops owl (*Otus lempiji*) from islands of the Malay Archipelago (Iwaki et al. 2012), and tawny owls (*Strix aluco*) from Moldavia, the Ukraine (Kornyushin 1989), and Spain (Campillo et al. 1994; Sanmartin et al. 2004; Santoro et al. 2012). Hobert et al. (1989) and Richardson and Kinsella (2010) reported the similar *Paruterina rauschi* Freeman, 1957 from northern spotted owls (*Strix occidentalis*) from Oregon and *S. varia* in Connecticut, respectively.

### Nematoda: Ascaridida: Ascaridae

#### *Porrocaecum depressum* (Zeder, 1800).

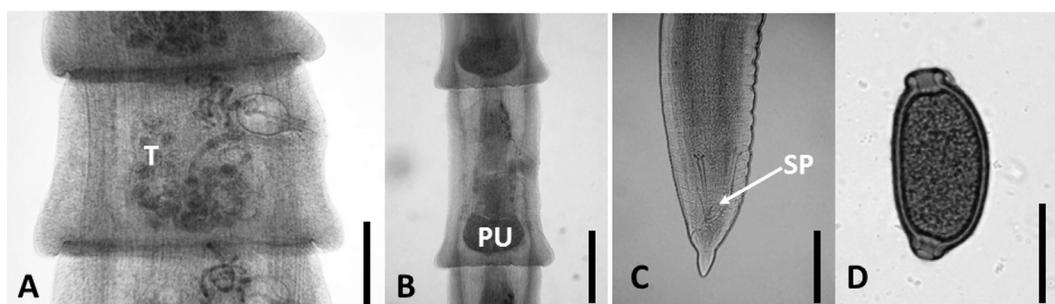
— Nematodes from the intestinal tract of a *M.*

*asio* were identified as *P. depressum* (Fig. 1C) based on the length of the esophagus and length of the spicules (425 µm). Previous reports of *P. depressum* from owls include *S. varia* from Florida (Kinsella et al. 2001) and Louisiana (Nadler and Hudspeth 1998), long-eared owl (*Asio otus*) and Eurasian eagle-owl (*Bubo bubo*) from Czech Republic (Sitko 1994), *B. virginianus* from Florida and Alberta and Manitoba, Canada (Wong et al. 1990; Kinsella et al. 2001), and northern spotted owl (*Strix occidentalis*) from Oregon (Hobert et al. 1989).

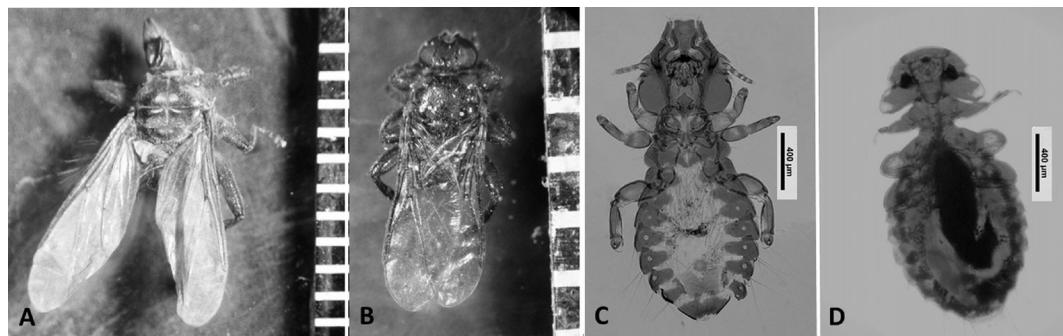
### Trichinellidae

***Capillaria* sp. (ova)** — More than 250 *Capillaria* species have been reported from fish, amphibians, reptiles, birds, and mammals (Cross 1992). Ova of a *Capillaria* sp. (Fig. 1D) were recovered from the feces of *S. varia* from the Hochatown site. Unfortunately, it is not possible to provide a specific identity of these eggs. Kinsella et al. (2001) reported *Capillaria tenuissima* (Rudolphi, 1819) from *S. varia* from Florida. This is the second time *Capillaria* sp. ova has been reported in any owl from the state (McAllister et al. 2017).

***Capillaria tenuissima* (Rudolphi, 1819).** — Many specimens of this nematode were found in the small intestine of a *B. virginianus*. This nematode has been previously reported from the great horned owl from Florida (Read 1949; Ramalingam and Samuel 1978; Kinsella et al. (2001) and Connecticut (Richardson and



**Figures 1A-D.** Some helminth parasites from two owls from Oklahoma. (A) Photomicrograph of a mature proglottid of *Paruterina candelabrarria* from *Strix varia* showing testes (T). (B) Pre-gravid proglottid of *P. candelabrarria* showing parauterine organ (PU); scale bars = 500 µm. (C) Posterior end of male *Porrocaecum depressum* from *Megascops asio* showing spicules (SP). Scale bar = 400 µm. (D) *Capillaria* ova from *S. varia*. Scale bar = 400 µm.



**Figures 2A–D.** Some ectoparasites collected from *Strix varia* from Oklahoma. (A) *Icosta americana* female; note scale (1 mm intervals). (B) *Ornithoica vicina* female; note scale (1 mm intervals). (C) *Strigiphilus syrnii* female. (D) *Kurodaia magna* female.

Kinsella 2010). It has also been documented from the Megallanic horned owl (*Bubo megellanicus*) from Chile (Grandón-Ojeda 2018) and various other owls (Atkinson et al. 2008).

#### Insecta: Diptera: Hippoboscidae

***Icosta americana* (Leach, 1817).** – One damaged female (Fig. 2A) was taken from *S. varia* from the Holly Creek site. Maa (1969) reports *I. americana* from across the Nearctic and parts of the Neotropical region from avians in the families Accipitridae (hawks and eagles), Phasianidae (ground-living birds), and Strigidae (owls). This species of hippoboscid is one of the most frequently collected from birds across the United States. It is one of the larger flies found on owls and since these birds are frequently studied it is well represented in most collections of hippoboscids. *Icosta americana* is also a potential vector of West Nile virus (Farajollahi et al. 2005). In addition several protistan blood parasites (*Haemoproteus* and *Trypanosoma*) are transmitted by *Icosta* spp. and other bird feeding hippoboscids (Reeves and Lloyd 2019). While not represented in published checklists from Oklahoma, there is a specimen from a bird hit by a car in Atoka County (Oklahoma) in the K. C. Emerson Entomology Museum at Oklahoma State University, Stillwater.

***Ornithoica vicina* (Walker, 1849).** – One female (Fig. 2B) was taken off *S. varia* from the same site above. *Ornithoica vicina* is one of the smallest hippoboscids parasitizing birds in North America. It has a wide host range being found on over 80 genera and 10 orders of birds from

Vancouver, Canada through Southern Chile into the Caribbean with an introduced population in Hawaii (Maa 1969b). There are no pathogens yet associated with this fly (Reeves and Lloyd 2019). Previous studies focusing on animals hit by cars have discovered *O. vicina* from *S. varia* (Nelder and Reeves 2005).

#### Phthiraptera: Ischnocera: Philopteridae

***Strigiphilus syrnii* (Packard, 1873).** – Lice are the most prevalent ectoparasites of raptors (Cooper 2002) and members within *Strigiphilus* represents the only genus with its taxa restricted to owl hosts (Clayton 1990). One female and two nymphs of *S. syrnii* (L3827A, Fig. 2C) were taken from *S. varia* from the Hochatown site. This louse is mainly an ectoparasite of the barred owl and it has been reported from specimens collected from Florida, Georgia, Minnesota, Pennsylvania, Virginia, Wisconsin, and British Columbia, Canada (Clayton and Price 1984). Other known hosts for *S. syrnii* are *B. virginianus*, great grey owl (*Strix nebulosa*), rufous-legged owl (*Strix rufipes*) and *S. occidentalis* from California, Connecticut, Maryland, Nebraska, Oregon, Texas, Washington (D.C.), and Québec and Saskatchewan, Canada (Clayton and Price 1984; Clayton 1990; Price et al., 2003). Emerson (1940) did not report this louse from Oklahoma, so we do here for the first time.

#### Amblycera: Menoponidae

***Kurodaia magna* Emerson, 1960.** – Three males, five females, and two nymphs of *K. magna* (L3827B, Fig. 2D) were removed from *S. varia* from the same site above. The species

was originally described from *S. varia* from Texas and paratypes were reported from the same host species from Alabama, Georgia, and Oregon (Emerson 1960). Other hosts include: *B. virginianus* and *S. occidentalis* from California and Oregon (Price and Beer 1963; Hunter et al. 1994; Price et al. 2003). This louse was not reported by Emerson (1940) in the state, so we report it, for the first time, from Oklahoma.

In conclusion, owls harbor a variety of ecto- and endoparasites, and the majority of them appear to be specific to raptors. Here, we document seven new distributional records for parasites of four owls from Oklahoma. We suggest that seven other species of owls that occur in the state, for which we know little or nothing about their parasites, should be examined including, northern saw-whet owl (*Aegolius acadicus*), short-eared owl (*Asio flammeus*), long-eared owl (*Asio otus*), burrowing owl (*Athene cunicularia*), snowy owl (*Bubo scandiacus*), western screech owl (*Megascops kennicottii*), and American barn owl (*Tyto furcata*). New geographic as well as the possibility of new host records would be expected when these owls are surveyed from Oklahoma.

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