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## New Records of Parasites (Apicomplexa, Nematoda, Acari, Anoplura) from Rodents in Arkansas

M. B. Connior

*NW Arkansas Community College, mconnior@nwacc.edu*

L. A. Durden

*Georgia Southern University, Statesboro, GA*

Chris T. McAllister

*Eastern Oklahoma St. College, cmcallister@se.edu*

R. S. Seville

*University of Wyoming, Casper, WY*

C. R. Burse

*Pennsylvania State University-Shenango Campus, Sharon, PA*

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### Authors

M. B. Connior, L. A. Durden, Chris T. McAllister, R. S. Seville, C. R. Bursey, and Henry W. Robison

## New Records of Parasites (Apicomplexa, Nematoda, Acari, Anoplura) from Rodents in Arkansas

M.B. Connior<sup>1\*</sup>, L.A. Durden<sup>2</sup>, C.T. McAllister<sup>3</sup>, R.S. Seville<sup>4</sup>, C.R. Bursey<sup>5</sup>, and H.W. Robison<sup>6</sup>

<sup>1</sup>Life Sciences, Northwest Arkansas Community College, Bentonville, AR 72712

<sup>2</sup>Department of Biology, Georgia Southern University, Statesboro, GA 30458

<sup>3</sup>Science and Mathematics Division, Eastern Oklahoma State College, Idabel, OK 74745

<sup>4</sup>Department of Zoology and Physiology, University of Wyoming, Casper, WY 82601

<sup>5</sup>Department of Biology, Pennsylvania State University-Shenango Campus, Sharon, PA 16146

<sup>6</sup>9717 Wild Mountain Drive, Sherwood, AR 72120

\*Correspondence: mconnior@nwacc.edu

Running Title: Parasites of Rodents in Arkansas

Compared to surrounding states, little is known about the coccidian parasites of rodents (McAllister and Kessler 2002; McAllister *et al.* 2008), and the ectoparasites of the wild mammals of Arkansas (Schiefer and Lancaster 1970; Whitaker and Wilson 1974; Whitaker *et al.* 2007; McAllister *et al.* 2013). Recently, limited work has been published on some ectoparasites of Arkansas rodents (McAllister *et al.* 2013; Tumilson *et al.* 2015). Here, we report information on a coccidian and some ectoparasites collected from rodents in the state.

Pocket gophers from Arkansas were collected as follows and examined for helminths and coccidian parasites: 10 Ozark pocket gophers (*Geomys bursarius ozarkensis*) were collected on 17-18 November 2012 from S of Melbourne at Lunenburg, Izard County; 16 Baird's pocket gophers (*Geomys breviceps*) were taken on 2 November 2012 from El Dorado, Union County; 5 *G. breviceps* were collected on 5 April 2013 from Bryant, Saline County; and 8 *G. breviceps* were taken on 15 April 2016 from Siloam Springs, Benton County. All were collected with Victor® Gopher kill traps. The gastrointestinal tract was examined for helminths and nematodes were fixed in 70% (v/v) ethanol and examined as temporary mounts in glycerol. Feces was collected from the rectum and placed in individual vials containing 2.5% (w/v) aqueous potassium dichromate (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>) and examined by light microscopy following flotation in Sheather's sugar solution (specific gravity = 1.30). Negative samples were discarded and one positive sample with unsporulated oocysts was allowed one week of sporulation at room temperature (ca. 23°C) in a Petri dish containing a thin layer of 2.5% (w/v) K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>. Oocysts were concentrated again with Sheather's and examined using a compound microscope equipped with Nomarski interference-contrast (DIC)

optics and were photographed and measured using Olympus Microsuite® software. Mean measurements are reported in micrometers (µm). A photovoucher of sporulated oocysts was accessioned into the Harold W. Manter Laboratory of Parasitology (HWML), Lincoln, NE as HWML 139189, Nematode parasites were also accessioned as HWML 99822.

One woodchuck (*Marmota monax*) from Benton County, 1 woodland vole (*Microtus pinetorum*) from Benton County, 4 white-footed mice (*Peromyscus leucopus*); 3 from Saline County and one from Marion County), 1 deer mouse (*Peromyscus maniculatus*) from Benton County, 1 eastern fox squirrel (*Sciurus niger*) from Marion County, and 1 hispid cotton rat (*Sigmodon hispidus*) from Benton County were collected between February 2013 and May 2017 with Sherman live traps and Museum Special® snap traps baited with rolled oats. After being euthanized following American Society of Mammalogists guidelines (Sikes *et al.* 2011), hair and skin of rodents were examined for ectoparasites. Chiggers and other mites were cleared in lactophenol, slide-mounted in Hoyer's medium (Walters and Krantz 2009), and identified using Whitaker (1982). Sucking lice were identified in ethanol using Kim *et al.* (1986). Voucher specimens of hosts are deposited in the mammal collection at Henderson State University (HSU), Arkadelphia, AR. Ectoparasites are deposited in the Entomology Collection in the Department of Biology at Georgia Southern University, Statesboro, GA (accession nos. L3795; L3800; L3802; L3806)

The following parasites were found in or on these rodents:

**Protista: Apicomplexa: Eimeriidae**

*Eimeria geomydis* Skidmore. Oocysts of a

coccidian matching the description of *E. geomydis* (Fig. 1) were found in 3 of 10 (30%) *G. b. ozarkensis*. Oocysts were subspheroidal, possessed a bilayered wall, measured (L × W) 13.0 × 11.9, and had a L/W ratio of 1.1. A micropyle, oocyst residuum, and polar granule were absent. Sporocysts were ovoidal and measured 7.9 × 4.5 with a L/W ratio of 1.8. In addition, a small Stieda body without substieda and parastieda bodies but a sporocyst residuum were present. In addition, 5 of 16 (31%) *G. breviceps* from Union County and 2 of 8 (25%) from Benton County harbored *E. geomydis*; none of the 5 *G. breviceps* from Saline County were infected. Skidmore (1929) originally described *E. geomydis* from plains pocket gopher (*Geomys bursarius*) from Nebraska. It has also been reported from *G. bursarius* from Missouri and Illinois, *G. breviceps* and Llano pocket gopher (*G. texensis*) from Texas (Upton *et al.* 1992), and northern pocket gophers (*Thomomys talpoides*) from New Mexico (Wilber *et al.* 1994). Here, we document a new distributional and host record for Arkansas, which harbors a subspecies of *G. bursarius* from which this coccidian has not been recorded.

#### Nematoda: Spiruroidea: Spirocercidae

Several spirurid nematodes, *Mastophorus muris* (Gemlin), were found in the stomach of 2 of 8 (25%) *G. breviceps* from Benton County (Fig. 2). Burnham (1953) reported *M. muris* from *G. bursarius* from Marshall County, Oklahoma. This nematode uses insects

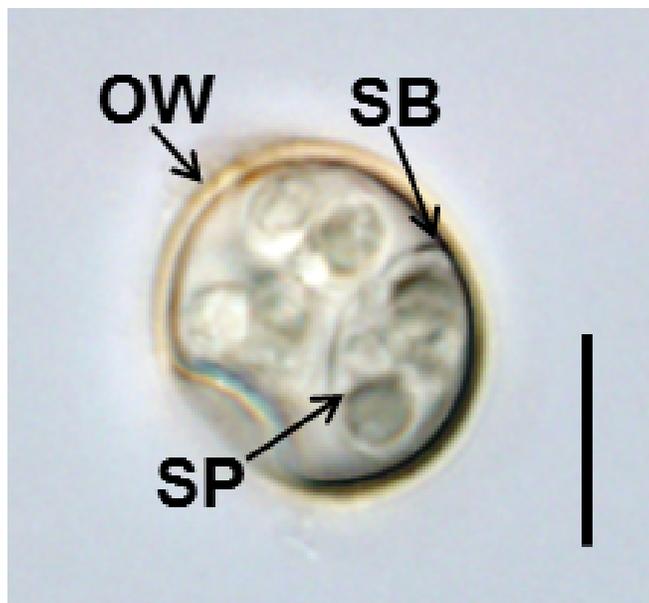


Figure 1. *Eimeria geomydis* oocyst from feces of *Geomys bursarius ozarkensis* showing oocyst wall (OW), Stieda body (SB), and sporocysts (SP). Scale bar = 5  $\mu$ m.



Figure 2. Heavy infection of spirurid nematodes in the stomach of a Baird's pocket gopher (*Geomys breviceps*) from Benton County.

as intermediate hosts and is a cosmopolitan species primarily infecting wild and urban rodents, but also other less frequent hosts such as marsupials and carnivores (Rojas and Digiani 2003). We document the first report of *M. muris* in *G. breviceps* or from Arkansas.

#### Acari: Trombiculidae

*Leptotrombidium peromysci* Vercammen-Grandjean and Langston. One *L. peromysci* larva was collected from *P. leucopus* from Marion County. This chigger is associated with several species of small and medium-sized mammals in the eastern U.S. (there is also a record from South Dakota) (Walters *et al.* 2011) but this represents the first record of this species from Arkansas. Some members of the genus *Leptotrombidium* in southeast Asia and the Pacific region are vectors of *Orientia tsutsugamushi*, the causative agent of scrub typhus (chigger-borne rickettsiosis) but Nearctic members of this genus are not known to transmit any pathogens (Traub and Wisseman 1974).

*Euschoengastia peromysci* (Ewing). One *E. peromysci* larva was collected from *P. leucopus* from Marion County. This is a widespread and common ectoparasite of several species of small mammals across the continental U.S. (Walters *et al.* 2011). It has been reported previously from *P. leucopus* in other states (Walters *et al.* 2011), but this is the first record of this chigger from this host in Arkansas. *Euschoengastia peromysci* has previously been reported from the eastern woodrat, *Neotoma floridana* in Arkansas (Tumlison *et al.* 2015).

## Parasites of Rodents in Arkansas

**Laelapidae**

***Androlaelaps fahrenheiti* (Berlese).** A single male and 6 nymphs of *A. fahrenheiti* were collected from a single *M. pinetorum* from Benton County. Additionally, 9 females and 9 nymphs of *A. fahrenheiti* were collected from a single *S. hispidus* from Benton County. This is a widespread and common Nearctic ectoparasite that has been reported previously from *M. pinetorum* and *S. hispidus* in other states (Whitaker *et al.* 2007), but these are the first ectoparasite records from these hosts in Arkansas. *Androlaelaps fahrenheiti* has previously been reported from golden mice (*Ochrotomys nuttalli*) and *N. floridana* in Arkansas (Tumlison *et al.* 2015).

***Laelaps kochi* Oudemans.** One female *L. kochi* was collected from *M. pinetorum* from Benton County. Although this vole-associated ectoparasite has been collected from *M. pinetorum* in other states, this is the first time this species has been collected in Arkansas (Whitaker *et al.* 2007).

**Listrophoridae**

***Listrophorus pitymys* Fain and Hyland.** A male and female *L. pitymys* were collected from a single *M. pinetorum* from Benton County. This represents a new state record for this species. It has only been collected previously from hosts in New York and Rhode Island. This species has been previously reported from *M. pinetorum* (Fain and Hyland 1972, 1974).

**Macronyssidae**

***Ornithonyssus bacoti* (Hirst).** The tropical rat mite was collected from a *P. maniculatus* from Benton County. Although this ectoparasite has been collected from *P. maniculatus* in other states, this is the first time it has been collected in Arkansas (Whitaker *et al.* 2007).

**Ixodidae**

***Amblyomma americanum* (Linnaeus).** Six nymphs of the lone star tick were collected from *M. monax* from Benton County. This is a commonly collected tick from a variety of mammalian hosts from Arkansas (McAllister *et al.* 2016) but there are few previous records from marmots. Further west, North American marmots are often parasitized by *Ixodes marmotae* Cooley and Kohls (Durden and Keirans 1996).

***Dermacentor variabilis* (Say).** One male American dog tick was collected from *M. monax* from Benton County. This is a commonly collected tick from a variety of mammalian hosts from Arkansas (McAllister *et al.* 2016).

**Anoplura: Hoplopleuridae**

***Hoplopleura hesperomydis* (Osborn).** Five males and 13 females of *H. hesperomydis* were collected from 2 of 3 (67%) *P. leucopus* from Saline County. This sucking louse is a widespread ectoparasite in North America and Mexico on at least 9 species of *Peromyscus* and also of *Ochrotomys nuttalli* (Durden and Musser 1994) but this is the first time it has been reported from Arkansas.

In conclusion, we document a coccidian, 5 species of mites (including 2 species of chiggers), 2 species of ticks, 1 species of sucking louse, and a nematode from rodents in Arkansas. Two new host and 6 new geographic records are reported. Clearly the coccidian and ectoparasite fauna, particularly the mite fauna, of Arkansas mammals is inadequately documented. Therefore, we recommend additional surveys of the parasites from Arkansas mammals to ensure necessary documentation of vectors and reservoirs of potential zoonoses.

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